Walkingame's

IMPROVED ARITHMETIC;

FOR THE USE OF SCHOOLS.

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531.d.33
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PUT INTO A MORE EASY, USEFUL, CONCISE, AND METHODICAL FORM, THAN ANY EXTANT.

THE FIRST EDITION.

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PREFACE.

Among the great number of Arithmetics, which have made their appearance, it may be supposed, that to attempt any alteration would be fruitless. But, on the contrary, if the different books of Arithmetics are examined, they will be found little more than copies of each other, abounding with many embarrassments and difficulties. Hence, the complaint is general, that Arithmetics are interlarded with useless rules and questions, that retard rather than accelerate the progress of youth. To remove this obstacle, the Publisher of the following sheets has thrown out such rules and questions as are useless in business, and has considerably enlarged the former part of the book, and disposed it in a more easy and methodical form.

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Explanation of the Characters.

$=$ *Equal.*	The sign of equality; as 4 qrs. $=$ 1 cwt. signifies that 4 qrs. are equal to 1 cwt.
$-$ *Minus or less.*	The sign of subtraction; as $8-2=6$; that is, 8 lessened by 2 is equal to 6.
$+$ *Plus or more.*	The sign of addition; as $4+4=8$; that is, 4 added to 4 more is equal to 8.
$\times$ *Multiplied by.*	The sign of multiplication; as $4\times 6=24$; that is, 4 multiplied by 6 is equal to 24.
$\div$ *Divided by.*	The sign of division; as $8\div 2=4$; that is, 8 divided by 2 is equal to 4.
$\frac{2357}{63}$	Numbers placed like a fraction do likewise denote division; the upper number being the dividend, and the lower the divisor.
$::$ *So is.*	The sign of proportion; as $2:4::8:16$; that is, as 2 is to 4 so is 8 to 16.
$7-2+5=10.$	Shews that the difference between 2 and 7 added to 5 is equal to 10.
$9-\overline{2+5}=2$	Signifies, that the sum of 2 and 5 taken from 9 is equal to 2.
$\sqrt{}$	Prefixed to any number, signifies the square root of that number is required.
$\sqrt[3]{}$	Signifies the cube, or third power.
$\sqrt[4]{}$	Denotes the biquadrate, or the fourth power, &c.
i. e.	*id est*, that is.

WALKINGAME'S ARITHMETIC
IMPROVED.

PART I.
ARITHMETIC IN WHOLE NUMBERS.

ARITHMETIC.

Arithmetic is the art of computing by numbers, and has five fundamental rules upon which all its operations depend; viz. Numeration, Addition, Subtraction, Multiplication, and Division.

Numeration

Teaches the different value of figures by their different places, and to read and write any sum or number.

THE TABLE.

Hundreds of millions	Tens of millions	Millions	Hundreds of thousands	Tens of thousands	Thousands	Hundreds	Tens	Units
9	8	7	6	5	4	3	2	1
	9	8	7	6	5	4	3	2
		9	8	7	6	5	4	3
			9	8	7	6	5	4
				9	8	7	6	5
					9	8	7	6
						9	8	7
							9	8
								9

The figure in the first place, reckoning from right to left, denotes only its simple value; that in the second place, ten times its simple value; that in the third, a hundred times its simple value; and so on; the value of any figure, in each successive place, being always ten times its former value.

Thus, in the number 4357, the 7 in the first place, signifies only 7; 5 in the second place, signifies 50; 3 in the third place, three hundred; the 4 in the fourth place, four thousand; and the whole is read thus, four thousand three hundred and fifty-seven.

EXAMPLES.

Write in figures the following numbers.

Thirty-six.
One hundred and twenty-five.
Two thousand and seventeen.
Thirty-seven thousand and forty-two.

Four hundred and thirteen thousand, one hundred and forty-one.

One million, two hundred thousand, six hundred and seventy-nine.

Seven hundred twenty-two millions, two hundred thirty-one thousand, five hundred and seven.

Write down in words the following numbers.

75
34
97

124
379
4168

3401743
1987419
142471062

INTEGERS.

Addition

Teaches to collect several numbers together to make one whole or total sum.

Rule 1. Great care must be had in placing the figures one under another, that is, units under units, tens under tens, &c.

2. Begin with the first row of units, add them to the top, then find how many tens are contained in their sum.

3. Set down the remainder, or if nothing remain, a cipher, and carry one for every ten to the next row.

4. Proceed thus to the last row, then set down the whole.

Proof 1. Imagine the top line to be cut off.

2. Add the rest together, and set their sum under the number to be proved.

3. Add this last sum to the top line, and if it be equal to the first sum it is right.

EXAMPLES.

	312	4156	9104
	674	7891	746
	916	4107	7291
	745	9243	214
	204	2784	4963
	619	3142	2642
Sum			
Proof			

What is the sum of 37, 401, 9471, 2164, 314, 974? *Ans.* 13361.

Add 246034, 298765, 47321, 58653, 64218, 5376, 9821, and 340 together. *Ans.* 730528.

If you give A 56*l.* B 104*l.* C 274*l.* D 391*l.* and E 713*l.* How much do you give in all? *Ans.* £1538.

How many days are there in the twelve calendar months? *Ans.* 365.

How many shillings are there in a guinea, a crown, and a pound? *Ans.* 46.

Three persons purchased a parcel of goods, A laid out 217*l.* B 349*l.* and C 107*l.* What was the price of the goods? *Ans.* £673.

Subtraction

Teaches to take a less number from a greater, and shews the difference.

Rule 1. Set the less number under the greater, units under units, tens under tens, &c. and draw a line under them.

2. Take each figure in the lower line, from each figure in the upper, beginning at the right hand, and set down the difference.

3. But if the upper figure be less than the lower, add ten to it, and then take the lower figure from it.

4. Set the difference down, and carry one to the next lower figure; and proceed as before, till the whole is finished.

Proof. Add the difference to the least number, and if the sum be equal to the top line, the work is right.

EXAMPLES.

From	4714	90171	374107
Take	1823	24624	145208
Dif.	2891		
Proof	4714		

From 51472 take 21749.

From 726431 take 434856.

What is the difference between 94172 and 39417?

A is 39 years old, B 24. How many years is A older than B? *Ans.* 15.

C has 523*l.* B has 349*l.* How much has C more than B? *Ans.* £174.

D has 171*l.* but he owes E 119*l.* How many pounds has he when his debt is paid? *Ans.* £52.

Multiplication

Is a short method of performing several additions.

The number to be multiplied is called the multiplicand.

The number you multiply by is called the multiplier.

The number produced by multiplying is called the product.

Rule 1. Set down the multiplicand and multiplier in such a form, as units may stand under units, tens under tens, &c. and draw a line under them.

2. Begin with that figure which stands on the right-hand of the multiplier, and with it multiply each figure in the multiplicand.

3. Set down that which remains above ten, under the figure you are multiplying by, (if nothing re-

mains, set down a cipher) and carry one in your mind for every ten, till you have multiplied the next figure in the multiplicand, by the same figure in the multiplier; to the product of which add the tens you kept in mind, setting down that which is above ten, and proceed as before till the whole is finished.

Proof. Make the former multiplicand the multiplier, and the multiplier the multiplicand, and if the product found from this operation, is the same as before, the work is right.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Multiplicand	417931
Multiplier	2
Product	835862

Multiply 910743 by 3.
Multiply 3249347 by 4.
Multiply 2703582 by 5.
Multiply 8425674 by 6.
Multiply 107461 by 7.
Multiply 9147342 by 8.
Multiply 2461493 by 9.
Multiply 6104759 by 11.
Multiply 2470461 by 12.

When the multiplier consists of several figures, there must be as many products as there are figures in the multiplier.

Set the first figure of every product under that you multiply by.

Add the several products together, and their sum will be the product.

21615	374562
16	37
129690	2621934
21615	823686
345840	10858794

Multiply 479434 by 19.
Multiply 340746 by 4317.
Multiply 9741671 by 7423.
Multiply 3827464 by 9785.

When ciphers are placed between the significant figures in the multiplier, they may be omitted; but the next figure must be put one place more to the left-hand, that is, under the figure you multiply by.

Multiply	25342
By	4007
	177394
	101368
Product	101545394

Multiply 174379 by 41005.
Multiply 743706 by 92002.
Multiply 914673 by 21003.

When there are ciphers at the end of the multiplicand, and multiplier, they may be omitted, by only multiplying by the rest of the figures, and setting down on the right-hand of the total product as many cyphers as were omitted.

Multiply

```
Multiply   946700
By           3400
        ---------
          37868
         28401
        ---------
Product 3218780000
        ---------
```

Multiply 2741000 by 45600.

Multiply 74200 by 3900.

When the multiplier is such a number, that if any two figures, being multiplied together, will make that number, then multiply the multiplicand by one of those figures, and that product multiplied by the other, will give the answer.

Multiply 46017 by 28 or by 7 times 4.

```
  46017
      7
-------
 322119
      4
-------
1288476 the product.
-------
```

Multiply 901746 by 42.

Multiply 16742 by 56.

Multiply 210467 by 63.

Division

Is a short way of performing several subtractions, and shews how often one number is contained in another, and what remains.

The number to be divided is called the dividend.

The number you divide by is called the divisor.

The number that shews how often the divisor is contained in the dividend, is called the quotient.

The accidental number, is what remains when the work is finished, and is of the same name as the dividend.

Rule 1. When the divisor is less than 12, find how often it is contained in the first figure of the dividend; set it down under the figure you divided, and carry the overplus (if any) to the next in the dividend, as so many tens; then find how often the divisor is contained therein, set it down, and continue the same till you have gone through the line.

2. When the divisor is more than 12, draw a curved line on the right side of the dividend, then find how many times the divisor is contained in as many figures of the dividend as are just necessary, and place the number on the right.

3. Multiply the divisor by this number, and put the product under the figures in the dividend.

4. Subtract this product from that part of the dividend under which it stands, and bring down the next figure of the dividend, to the right of the remainder, and proceed as before, till the figures are all brought down.

Proof. Multiply the divisor and quotient together, adding the remainder (if any) and if the product be the same as the dividend, the work is right.

EXAMPLES,

Dividend.
Divisor 2)317435
158717—1 Rem.
2
Proof 317435

Divide 710472 by 3.
Divide 247914 by 4.
Divide 351692 by 5.
Divide 9271046 by 6.
Divide 4017472 by 7.
Divide 41607431 by 8.
Divide 91074624 by 9.
Divide 19046142 by 11.
Divide 20416741 by 12.

```
49)34790174      (710003 Quotient.
   343               49
   ---            -------
    49            6390027
    49            2840012
   ----                27 Rem.
     0174         -------
      147        34790174 Proof
     ----        --------
       27 Rem.
     ----
```

Divide 473674947 by 97. *Ans.* 4883246$\frac{85}{97}$.
Divide 32749467 by 347. *Ans.* 94378$\frac{301}{347}$.
Divide 90174928 by 749. *Ans.* 120393$\frac{571}{749}$.
Divide 34764219 by 2017.
Divide 734097143 by 5743.
Divide 610478407 by 34716.
Divide 497340189 by 510834.
Divide 317045678 74 by 4756034.
Divide 74537894613 by 2147946.

Rule. When there are ciphers at the end of the divisor, cut them off, and as many places from the right-hand of the dividend; then divide the remaining figures, as usual, and the quotient will be the answer.

But should there be any remainder after this division, put the figures cut off from the dividend, to the right-hand of it, and it will be the true remainder.

```
271|00)2547324|24(939 Quotient.
       2439
       ----
        1083
         813
        ----
        2702
        2439
        ----
        26324 Rem.
        -----
```

Divide 84736349 by 37000.
Divide 107946743 by 94000.

When the divisor is such a number that any two figures being multiplied together will make that number, then divide the dividend by one of those figures, and that quotient by the other, will give the answer.

But when there is a remainder to each of the quotients, and neither of them the true one, the true one may be found by multiplying the first divisor into the last remainder, adding this product to the first remainder, which will give the true one.

Divide 3210473 by 27, or by 9 and 3.

9)3210473

3)356719—2

Quotient 118906—1 × 9 + 2 = 11 Rem.

Divide 4174624 by 36.
Divide 1705743 by 96.

Addition

of MONEY, WEIGHTS, and MEASURES.

RULE 1. Place the numbers so that those of the same denomination may stand under each other.

2. Begin at the right-hand, and add up the first row to he top.

3. Divide this sum by as many of the same denomination as make one of the next greater, setting down the remainder under that row added, and carry the quotient to the next superior denomination, continuing the same to the last, which add as in simple addition.

The method of proof the same as in integers.

TABLES OF MONEY.

Marked	
$\frac{1}{4}$	*Farthing.*
$\frac{1}{2}$	*Halfpenny.*
$\frac{3}{4}$	*Three Farthings.*

			Marked
4 Farthings	make	1 Penny.	*d.*
12 Pence	—	1 Shilling.	*s.*
20 Shillings	—	1 Pound.	*l.*

Farthings.
4 = 1 *Penny.*
48 = 12 = 1 *Shilling.*
960 = 240 = 20 = 1 *Pound.*

SHILLINGS.

s.		*£.*	*s.*
20	is	1	0
30		1	10
40		2	0
50		2	10
60		3	0
70		3	10
80		4	0
90		4	10
100		5	0
110		5	10
120		6	0
130		6	10

PENCE TABLE.

d.		*s.*	*d.*	*d*		*s.*	*d.*
20	is	1	8	90	is	7	6
24		2	0	96		8	0
30		2	6	100		8	4
36		3	0	108		9	0
40		3	4	110		9	2
48		4	0	120		10	0
50		4	2	130		10	10
60		5	0	132		11	0
70		5	10	140		11	8
72		6	0	144		12	0
80		6	8	150		12	6
84		7	0	160		13	4

EXAMPLES OF MONEY.

	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
	7	13	4½	25	10	7¼	18	17	2
	9	11	11¾	37	19	4	19	10	10½
	8	15	8½	45	17	6½	47	18	9¾
	4	17	9	29	14	8¾	38	12	10¼
	6	19	7¾	30	15	5¾	49	19	4½
	8	10	6	65	18	11½	28	17	8
Sum									
Proof									

£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
527	11	2¾	47	11	4¼	123	14	7
347	17	4¼	39	19	10	342	17	4¾
894	19	7½	78	4	7¾	409	13	10¼
627	12	8¼	26	13	2½	274	19	9
706	10	11	58	17	9	716	12	4½
107	17	4¼	61	15	3¾	174	3	8
519	9	10	92	18	11	419	15	7½

£	s.	d.	£	s.	d.	£	s.	d.
914	14	7½	124	17	4¼	2017	13	2
346	19	4	291	10	7½	584	17	3½
67	10	9¾	914	14	10¼	1427	10	8¾
19	4	11¼	49	2	5¾	19	18	9
472	18	7½	271	13	4	7145	15	5¼
367	12	5	912	15	6½	1072	11	6½

The Application.

A person being desirous to know how much money he had owing, said, that A owed him 47*l.* 18*s.* 9¼*d.* B 34*l.* 11*s.* 7*d.* C 78*l.* 14*s.* 6*d.* and D 28*l.* 15*s.* 7½*d.* How much had he owing in all?

Ans. £190 0*s.* 5¼*d.*

A, B, C, D went partners in the purchase of a quantity of goods; A laid out 7*l.* half a guinea, and a crown; B 49*s.*; C 54*s.* 6*d.*; and D 87*d.* What was laid out in all? *Ans.* £13 6*s.* 3*d.*

Four persons discoursing together, A said he had 3*l.* 17*s.* 9*d.*; B said he had 9*l.* 17*s.* 3*d.*; C that he had 9*l.* 2*s.* 6*d.*; and D 1*l.* 18*s.* 7*d.* How much had they all?

Ans. £24 16*s.* 1*d.*

A man lent his friend at different times these several sums, viz. 63*l.*; 25*l.* 15*s.*; 32*l.* 7*s.*; 15*l.* 14*s.* 10*d.*; and fourscore and nineteen pounds, half a guinea, and a shilling. How much did he lend in all? *Ans.* £236 8*s.* 4*d.*

A owes D for flour 3*l.* 17*s.* 6¼*d.*; for butter 2*l.* 10*s.* 7*d.*; for cheese 5*l.* 16*s.*; for bread 4*l.* 14*s.* 7*d.*; for sundry articles 58*l.* 12*s.* How much is the whole debt?

Ans. £75 10*s.* 8¼*d.*

Bought a parcel of goods, for which I paid 54*l.* 17*s.*; for packing 13*s.* 8*d.*; carriage 1*l.* 5*s.* 4d.; and spent about the bargain 14*s.* 3*d.* What did these goods stand me in?

Ans. £57 10*s.* 3*d.*

A gentleman left his eldest daughter 1500*l.* more than the youngest, and her fortune was 12111*l.* What was the eldest sister's fortune, and what did the father leave them? *Ans.* eldest sister's fortune 13611*l.* Father left them 25722*l.*

EXAMPLES OF WEIGHTS AND MEASURES.

TROY WEIGHT.

TABLES.

			Marked
24 Grains —	make —	1 Pennyweight.	*gr.* *dwts.*
20 Pennyweights	— —	1 Ounce —	*oz.*
12 Ounces —	— —	1 Pound —	*lb.*

Grains.

24 = 1 Pennyweight.
480 = 20 = 1 Ounce.
5760 = 240 = 12 = 1 Pound.

By this weight are weighed Gold, Silver, Jewels, Electuaries, and all Liquors.

EXAMPLES.

	lb.	*oz.*	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*gr.*
	41	10	17	21	147	9	15	19
	52	9	12	17	314	11	10	12
	74	2	14	22	972	4	17	22
	97	8	15	19	216	2	17	17
	58	11	17	12	429	7	18	10
	36	4	2	13	216	1	12	18
Sum								

AVOIRDUPOISE WEIGHT.

TABLES.

			Marked
16 Drams — — —	make	1 Ounce —	*dr.* *oz.*
16 Ounces — — — —		1 Pound —	*lb.*
28 Pounds — — — —		1 Quarter —	*qrs.*
4 Quarters, or 112 *lb.* —		1 Hundred Weight.	*cwt.*
20 Hundred Weight —		1 Ton —	*Ton.*

Drams.

16 = 1 *Ounce.*

256 = 16 = 1 *Pound.*

7168 = 448 = 28 = 1 *Quarter.*

28672 = 1792 = 112 = 4 = 1 *Cwt.*

575440 = 35840 = 2240 = 80 = 20 = 1 *Ton.*

By this weight are weighed all things of a coarse or drossy nature, as butter, cheese, flesh, grocery wares, and some liquids, bread, corn, &c. and all metals, except gold and silver; but several kinds of silks are weighed by a *lb.* of 24 *oz.*; and butter, in some countries, is from 16 to 32 *oz.* in a *lb.*

EXAMPLES.

cwt.	*qrs.*	*lb.*	*oz.*	*dr.*
34	3	21	14	13
27	1	12	13	10
49	—	4	7	9
91	2	—	10	12
74	1	24	15	11
36	2	19	14	12

T.	*cwt.*	*qrs.*	*lb.*
94	17	2	21
27	14	1	25
39	18	3	19
78	12	—	21
31	13	2	14
99	15	1	16

APOTHECARIES WEIGHT.

TABLES.

					Marked
20 Grains	—	make 1 Scruple		—	℈
3 Scruples	—	—	1 Dram	—	ʒ
8 Drams	—	—	1 Ounce	—	℥
12 Ounces	—	—	1 Pound	—	℔

Grains.

20 = 1 *Scruple.*

60 = 3 = 1 *Dram.*

480 = 24 = 8 = 1 *Ounce.*

5760 = 288 = 96 = 12 = 1 *Pound.*

Note. The Apothecaries mix their medicines by this rule, but buy and sell their commodities by avoirdupoise weight.

EXAMPLES.

℔	℥	ʒ	℈	gr.
24	7	2	1	16
32	9	7	2	12
94	10	6	1	19
37	9	2	—	14
41	11	5	2	15
58	8	4	1	17

ʒ	℈	gr.
21	2	17
33	1	12
56	—	13
29	2	12
36	1	18
92	2	12
12	1	13

CLOTH MEASURE.

TABLE.

			Marked
4 Nails	—	make 1 Quarter of a Yard	*n.* *qrs.*
3 Quarters	—	— 1 Flemish Ell —	*F. E.*
4 Quarters	—	— 1 Yard —	*yd.*
5 Quarters	—	— 1 English Ell —	*E. E.*
6 Quarters	—	— 1 French Ell —	*Fr. E.*

EXAMPLES.

yds.	*qrs.*	*n.*	*E.E.*	*qrs.*	*n.*	*F.E.*	*qrs.*	*n.*
14	3	2	34	4	3	34	2	3
27	1	3	27	3	1	17	1	2
34	2	2	91	1	2	28	2	1
47	1	3	36	2	1	34	1	2
26	2	2	45	3	3	45	2	1
34	1	1	21	4	1	36	1	2

LONG MEASURE.

TABLES.

					Marked
3	Barley Borns	make	1 Inch	—	*bar.* *in.*
12	Inches	—	1 Foot	—	*feet.*
3	Feet	—	1 Yard	—	*yd.*
6	Feet	—	1 Fathom	—	*fth.*
5½	Yards	—	1 Rod, Pole, or Perch		*rod, p.*
40	Poles	—	1 Furlong	—	*fur.*
8	Furlongs	—	1 Mile	—	*mile.*
3	Miles	—	1 League	—	*lea.*
60	Miles	—	1 Degree	—	*deg.*

Barley Corns.						
3=	1 *Inch.*					
36=	12=	1 *Foot.*				
108=	36=	3 =	1 *Yard.*			
594=	198=	16½=	5½=	1 *Pole.*		
23760=	7920=	660 =	220 =	40=	1 *Furlong.*	
190080=	63360=	5280 =	1760 =	320=	8=	1 *Mile.*

EXAMPLES.

yds.	*feet.*	*in.*	*bar.*
471	2	11	2
34	1	9	1
941	2	4	2
74	—	7	1
124	1	3	—
247	2	5	2

lea.	*m.*	*fur.*	*p.*
27	2	7	24
31	1	4	31
94	2	6	19
14	—	4	12
72	2	5	17
35	1	5	29

LAND MEASURE.

TABLES.

					Marked
144	Inches	— make	1 Square Foot	—	*ft.*
9	Square Feet	—	1 Square Yard	—	*yd.*
30¼	Square Yards	—	1 Square Pole	—	*p.*
40	Square Poles	—	1 Rood	—	*rd.*
4	Roods	—	1 Acre	—	*acr.*

Inches.

144= 1 *Foot.*

1296= 9 = 1 *Yard.*

39204= 272¼= 30¼= 1 *Pole.*

1568160= 10890 = 1210 = 40= 1 *Rood.*

6272640= 43560 = 4840 = 160= 4= 1 *Acre.*

By this measure, land, husbandmen and gardeners' work are measured; and board, glass, pavements, plaistering, wainscotting, tiling, flooring, and every dimension of length and breadth only.

EXAMPLES.

acr.	*rd.*	*p.*	*acr.*	*rd.*	*p.*
41	3	34	55	1	19
22	1	19	37	3	37
17	2	17	21	2	24
37	1	24	34	1	25
46	2	13	29	3	32
54	3	19	41	2	19

WINE MEASURE.

TABLES.

			Marked
2	Pints make	1 Quart	*pt. qt.*
4	Quarts	1 Gallon	*gal.*
10	Gallons	1 Anchor of Brandy	*anc.*
18	Gallons	1 Runlet	*run.*
31½	Gallons	Half an Hogshead	*½hhd.*
42	Gallons	1 Tierce	*tierce.*
63	Gallons	1 Hogshead	*hhd.*
2	Hogsheads	1 Pipe or Butt	*P.* or *Butt.*
2	Pipes, or 4 Hogsheads	1 Tun	*tun.*

Inches.

28⅞= 1 *Pint.*

57¾= 2= 1 *Quart.*

231 = 8= 4= 1 *Gallon.*

9702 = 336= 168= 42=1 *Tierce.*

14553 = 504= 252= 63=1½=1 *Hogshead.*

19404 = 672= 336= 84=2 =1⅓=1 *Puncheon.*

29106 =1008= 504=126=3 =2 =1½=1 *Pipe.*

58212 =2016=1008=252=6 =4 =3 =2=1 *Tun.*

All brandies, spirits, perry, cyder, mead, vinegar, honey, and oil, are measured by this measure; as also milk: not by law, but custom only.

EXAMPLES.

hhd.	*gal.*	*qt.*	*p.*
45	62	3	1
24	24	1	—
37	35	2	1
91	42	1	1
38	39	2	—
41	27	2	1

tun.	*p.*	*hhd.*	*gal.*	*qt.*
42	1	1	62	3
27	1	—	14	1
39	—	1	39	2
65	1	1	47	1
32	1	0	58	3
92	1	1	39	2

ALE AND BEER MEASURE.

TABLES.		Marked
2 Pints make	1 Quart	*pts.* *qts.*
4 Quarts	1 Gallon	*gal.*
8 Gallons	1 Firkin of Ale	*A. fir.*
9 Gallons	1 Firkin of Beer	*B. fir.*
2 Firkins	1 Kilderkin	*Kil.*
4 Firkins, or 2 Kilderkins	1 Barrel	*Bar.*
1 Barrel and ½, or 54 Gallons	1 Hogshead of Beer	*hhd.*
2 Barrels	1 Puncheon	*pun.*
3 Barrels, or 2 Hogsheads	1 Butt	*butt.*
2 Butts	1 Tun	*tun.*

BEER.

Cubic Inches.

$35\frac{1}{4}$ = 1 *Pint.*

$70\frac{1}{2}$ = 2 = 1 *Quart.*

282 = 8 = 4 = 1 *Gallon.*

2538 = 72 = 36 = 9 = 1 *Firkin.*

5076 = 144 = 72 = 18 = 2 = 1 *Kilderkin.*

10152 = 288 = 144 = 36 = 4 = 2 = 1 *Barrel.*

15228 = 432 = 216 = 54 = 6 = 3 = $1\frac{1}{2}$ = 1 *Hogshead.*

20304 = 576 = 288 = 72 = 8 = 4 = 2 = 1 *Puncheon.*

30456 = 864 = 432 = 108 = 12 = 6 = 3 = 2 = 1 *Butt.*

ALE.

Cubic Inches.

$35\frac{1}{4}$ = 1 *Pint.*
$70\frac{1}{2}$ = 2 = 1 *Quart.*
282 = 8 = 4 = 1 *Gallon.*
2256 = 64 = 32 = 8 = 1 *Firkin.*
4512 = 128 = 64 = 16 = 2 = 1 *Kilderkin.*
9024 = 256 = 128 = 32 = 4 = 2 = 1 *Barrel.*
13536 = 384 = 192 = 48 = 6 = 3 = $1\frac{1}{2}$ = 1 *Hogshead.*

EXAMPLES.

A.B.	*fir.*	*gal.*	*B.B.*	*fir.*	*gal.*	*hhd.*	*gal.*	*qt.*
21	3	7	31	3	8	22	52	3
34	1	4	25	2	7	37	41	1
23	2	5	92	3	4	27	32	2
67	1	—	27	1	5	41	50	1
31	3	3	42	2	6	37	44	2
29	2	4	33	1	3	58	27	1

DRY MEASURE.

TABLES.

			Marked
2 Pints	make 1	Quart	*qt.*
2 Quarts	1	Pottle	*pot.*
2 Pottles	1	Gallon	*gal.*
2 Gallons	1	Peck	*pk.*
4 Pecks	1	Bushel	*bu.*
2 Bushels	1	Strike	*strike.*
4 Bushels	1	Coom	*coom.*
2 Cooms, or 8 Bushels	1	Quarter	*qr.*
4 Quarters	1	Chaldron	*chal.*
5 Quarters	1	Wey	*wey.*
2 Weys	1	Last	*last.*

In London 36 bushels make a chaldron.

Solid Inches.

$268\frac{4}{5}$ = 1 *Gallon.*

$537\frac{3}{5}$ = 2 = 1 *Peck.*

$2150\frac{2}{5}$ = 8 = 4 = 1 *Bushel.*

$4300\frac{4}{5}$ = 16 = 8 = 2 = 1 *Strike.*

$8601\frac{3}{5}$ = 32 = 16 = 4 = 2 = 1 *Coom.*

$17203\frac{1}{5}$ = 64 = 32 = 8 = 4 = 2 = 1 *Quarter.*

86106 = 320 = 160 = 40 = 20 = 10 = 5 = 1 *Wey.*

172032 = 640 = 320 = 80 = 40 = 20 = 10 = 2 = 1 *Last.*

The bushel in Water Measure is 5 pecks.
A score of coals is ....21 chaldron.
A sack of coals .... 3 bushels.
A chaldron of coals ....12 sacks.
A load of corn .... 5 bushels.
A cart load, ditto ....40 bushels.

This measure is applied to all dry goods.

The standard bushel is 18 inches and ½ wide, and 8 inches deep.

EXAMPLES.

last.	*wey.*	*qrs.*	*bu.*	*pks.*
27	0	4	3	3
31	1	2	1	2
42	1	3	2	1
56	1	0	3	2
52	0	4	2	3
21	1	2	1	2

ch.	*bu.*	*p.*
42	24	3
24	17	1
36	19	2
57	29	1
72	18	3
41	19	2

TIME.

TABLES.

		Marked
60 Seconds make..........	1 Minute	*sec.* *m.*
60 Minutes...............	1 Hour	*hour.*
24 Hours	1 Day	*day.*
7 Days	1 Week...........	*week.*
4 Weeks..................	1 Month	*mo.*
13 Months, 1 Day, 6 Hours	1 Julian Year	*yr.*

Seconds.
60= 1 *Minute.*
3600= 60= 1 *Hour.*
86400= 1440= 24= 1 *Day.*
604800= 10080= 168= 7=1 *Week.*
2419200= 40320= 672=28=4=1 *Month.*
d h w d h
31557600=525960=8766=365:6=52:1:6=1 *Julian Year.*
d h m ''
31556937=525948=8765=365:5:48:57=1 *Solar Year.*

To know the Days in each Month, observe:
Thirty Days hath September,
April, June, *and* November:
February *hath Twenty-eight alone,*
All the rest have Thirty-one;
Except in Leap Year, *when, in fine,*
February's *Days are Twenty-nine.*

EXAMPLE.

yrs.	*mo.*	*weeks.*	*days.*	*hours.*	*m.*	*sec.*
27	11	3	6	23	54	44
36	8	1	4	19	32	27
95	10	2	5	13	57	36
76	4	3	3	17	34	49
39	3	0	1	14	0	17
24	0	2	5	19	55	37

THE APPLICATION.

A grocer buys 2 *qrs.* 22 *lb.* of coffee; 1 *cwt.* 2 *qrs.* 21 *lb.* of teas; 2 *cwt.* 1 *qr.* 15 *lb.* of sugars; 4 *lb.* 12 *oz.* 8 *dr.* of spices. What is the weight of the whole?

Ans. 4 *cwt.* 3 *qrs.* 6 *lb.* 12 *oz.* 8 *dr.*

A gentleman bought 3 pieces of land, one contained 3 acres, 2 roods, 23 poles; another, 5 acres, 1 rood, 32 poles; and the third, 7 acres, 2 roods, 35 poles. How many acres, &c. were there in the whole?

Ans. 16 *acr.* 3 *rds.* 10 *p.*

Add 21 *lb.* 3 *oz.* 4 *dwt.* 19 *gr.*; 31 *lb.* 11 *oz.* 17 *dwt.* 21 *gr.*; 12 *lb.* 5 *oz.* 12 *dwt.* 13 *gr.*; 42 *lb.* 4 *oz.* 7 *dwt.* 22 *gr.* together. *Ans.* 108 *lb.* 3 *oz.* 4 *dwt.* 19 *gr.*

An innkeeper bought of a brewer at one time, 4 hogsheads, 25 gallons of beer; at another, 7 hogsheads, 32 gallons; and at another, 2 tuns, 2 hogsheads, 52 gallons. How many tuns, &c. did he buy in all?

Ans. 5 *tuns,* 3 *hhds.* 1 *gal.*

A bought of B, 5 English ells, 4 quarters, 2 nails; at another time, 4 ells, 3 quarters, 1 nail; and at another, 7 ells, 4 quarters, 3 nails. How much did he buy in all?

Ans. 18 *ells,* 2 *qrs.* 2 *n.*

If the distance from Liverpool to Manchester be 37 miles, 6 furlongs, 35 poles; from Manchester to Halifax, 29 Miles, 6 furlongs; from Halifax to Leeds, 17 miles, 7 furlongs, 36 poles. How far is it from Liverpool to Leeds? *Ans.* 85 *miles.* 4 *fur.* 31 *p.*

Subtraction

of MONEY, WEIGHTS, and MEASURES.

Rule 1. Put the less number under the greater, so that those parts which are of the same name may stand underneath each other.

2. Begin at the right-hand, and subtract as in integers, observing that if the lower line be greater than the upper, borrow as many of that as make one in the next higher denomination, adding it to the upper; then subtract the lower number from the upper, and set down the difference.

3. Carry one for that which you borrowed to the next number in the lower line, which subtract as before, proceeding in the same manner, till the whole is finished; and the several remainders will be the difference required.

PROOF. As in integers.

EXAMPLES OF MONEY.

	£.	s.	d.
From	8	12	6¼
Take	4	19	8
Rem.	3	12	10¼
Proof	8	12	6¼

	£.	s.	d.
Lent	36	17	9½
Rec.	13	18	10¾

	£.	s.	d.
From	99	12	3
Take	49	14	4¼

	£.	s.	d.
From	126	13	4½
Take	108	14	6

From 74*l.* 13*s.* 4½*d.* take 25*l.* 16*s.* 7¼*d.*

From 348*l.* 12*s.* 9½*d.* take 136*l.* 17*s.* 8¼*d.*

From 794*l.* 13*s.* 4½*d.* take 417*l.* 18*s.* 7½*d.*

What is the difference between 112*l.* 14*s.* 6*d.* and 79*l.* 16*s.* 1*d.*?

THE APPLICATION.

A had 415*l.* 12*s.* 7*d.*; but he owed B 235*l.* 17*s.* 4*d.* How much would he have, if his debt were paid? *Ans.* £179 15*s.* 3*d.*

Lent 391*l.* 17*s.*; received 236*l* 14*s.* How much is due to me? *Ans.* £155 3*s.*

Borrowed of my friend 520*l.* 16*s.*; paid him at different times these following sums, viz. 134*l.* 15*s.*; 110*l.* 12*s.* 6*d.*; and 94*l.* 15*s.* 6*d.* How much do I stand indebted to him? *Ans.* £180 13*s.*

A merchant had three debtors, A, B, and C, which together owed him 467*l.*; A and B owed him 256. What was C's debt? *Ans.* £211.

A manufacturer had owing to him 641*l.* 3*s.* 7*d.* and received at one time 75*l.* 12*s.*; at another 112*l.* 12*s.* 6*d.*; at another 95*l.* 13*s.* 6*d.* What remains due to him? *Ans.* £357 5*s.* 7*d.*

A merchant, at his out-setting in trade, owed 750*l.*; he had in cash, commodities, the stocks, and good debts, 12510*l.*

12510*l.* 7*s.*; he cleared the first year by commerce, 452*l.* 3*s.* 5*d.* What was the net balance at the year's end?

Ans. 12212*l.* 10*s.* 5*d.*

EXAMPLES OF WEIGHTS AND MEASURES.

TROY WEIGHT.

	lb.	*oz.*	*dwt.*	*gr.*
From	31	1	12	17
Take	19	10	18	21
Rem.				

lb.	*oz.*	*dwt.*	*gr.*
51	4	13	12
22	10	12	23

AVOIRDUPOISE WEIGHT.

	cwt.	*qrs.*	*lb.*	*oz.*	*dr.*
From	72	1	19	10	12
Take	34	3	22	12	15
Rem.					

T.	*cwt.*	*qrs.*	*lb.*
27	14	2	13
19	17	1	21

APOTHECARIES WEIGHT.

℔	℥	ʒ	℈	*gr.*
36	5	2	1	12
21	9	5	2	17

ʒ	℈	*gr.*
29	2	13
17	1	14

CLOTH MEASURE.

yds.	*qrs.*	*n.*
42	2	1
27	3	2

E.E.	*qrs.*	*n.*
57	1	2
32	4	3

F.E.	*qrs.*	*n.*
89	2	1
56	2	3

LONG MEASURE.

yds.	*feet.*	*in.*	*bar.*
71	1	8	2
38	2	10	1

lea.	*m.*	*fur.*	*p.*
45	2	4	21
27	1	7	32

LAND MEASURE.

acr.	*rd.*	*p.*
62	2	21
39	3	32

acr.	*rd.*	*p.*
35	1	24
19	2	29

WINE MEASURE.

hhd.	*gal.*	*qt.*	*pt.*
49	43	2	1
25	57	3	0

tun.	*p.*	*hhd.*	*gal.*	*qt.*
91	0	1	21	2
39	1	0	49	1

ALE AND BEER MEASURE.

A.B.	*fir.*	*gal.*
79	2	2
39	3	7

B.B.	*fir.*	*gal.*
32	1	4
17	2	8

hhd.	*gal.*	*qt.*
77	34	1
32	51	2

DRY MEASURE.

last.	*wey.*	*qrs.*	*bu.*	*pk.*
84	0	2	1	2
45	1	3	2	3

ch.	*bu.*	*pk.*
67	21	2
52	27	3

TIME.

yrs.	*mo.*	*weeks.*	*days.*	*hours.*	*m.*	*sec.*
39	5	2	4	13	29	13
17	9	3	5	12	45	57

THE APPLICATION.

A gentleman had a piece of land which contained 7 acres, 1 rood, 27 poles, of which he sold 3 acres, 2 roods, 35 poles. What remains unsold? *Ans.* 3 *acr.* 2 *rd.* 32 *p.*

A has 25 *lb.* 4 *oz.* 13 *dwt.* 11 *gr.* of gold; B has 13 *lb.* 8 *oz.* 15 *dwt.* 21 *gr.* How much has A more than B?
Ans. 11 *lb.* 7 *oz.* 17 *dwt.* 14 *gr.*

B walked 43 miles, 2 furlongs, in one day; C walked 57 miles, 6 furlongs, 31 poles. How many miles, &c. did C walk more than B? *Ans.* 14 *m.* 4 *fur.* 31 *p.*

A grocer bought 40 *cwt.* 3 *qrs.* 13 *lb.* of sugar; he sold out at one time, 13 *cwt.* 1 *qr.* 12 *lb*; at another, 15 *cwt.* 2 *qrs.* 10 *lb.* How much remains unsold?
Ans. 11 *cwt.* 3 *qrs.* 19 *lb.*

From 127 English ells take 94 ells, 2 quarters, 1 nail.
Ans. 32 *ells.* 2 *qrs.* 3 *n.*

From 536 yards take 312 yards, 2 quarters, 3 nails.
Ans. 223 *yds.* 1 *qr.* 1 *n.*

Multiplication

of MONEY, WEIGHTS, and MEASURES.

Rule 1. Put the multiplier under the lowest denomination of the multiplicand.

2. Multiply the lowest denomination by the multiplier, dividing the product by as many of that as make one of the next higher denomination, setting down the remainder, and add the quotient to the next superior, after it is multiplied, with which proceed as before till the whole is finished, and the several remainders, taken as one number, will be the answer.

PROOF. As in multiplication of integers.

EXAMPLES OF MONEY.

7 *cwt.* of Malaga raisins, at 1*l.* 1*s.* 6*d.* per *cwt.*

£.	*s.*	*d.*
1	1	6
		7
7	10	6 *Answer.*

9 *lb.* of loaf sugar at 1*s.* $4\frac{1}{4}$*d.* per *lb.* *Ans.* 12*s.* $2\frac{1}{4}$*d.*

6 barrels of herrings, at 3*l.* 15*s.* 7*d.* per barrel.
Ans. 22*l.* 13*s.* 6*d.*

12 *lb.* of green tea, at 8*s.* 6*d.* per *lb.* *Ans.* 5*l.* 2*s.*
5 *lb.* of tobacco, at 2*s.* 6½*d.* per *lb.* *Ans.* 10*s.* 2*d.*
8 *cwt.* of cheese, at 1*l.* 5*s.* 7*d.* per *cwt.* *Ans.* 10*l.* 4*s.* 8*d.*

When the multiplier exceeds 12, and is such a number that any two figures multiplied together will make that number, then multiply by one of those figures, and that product multiplied by the other, will give the answer.

EXAMPLES.

18 yards of cloth, at 9*s.* 6*d.* per yard.

£.	*s.*	*d.*	
0	9	6	
		6	
2	17	0	
		3	
£8	11	0	*Ans.*

21 ells of holland, at 7*s.* 8½*d.* per ell. *Ans.* 8*l.* 1*s.* 10*d.*
28 yards of broad cloth, at 19*s.* 4*d.* per yard. *Ans.* 27*l.* 11*s.* 4*d.*
35 firkins of butter, at 15*s.* 3½*d.* per firkin. *Ans.* 26*l.* 15*s.* 2½*d.*
72 pair of gloves, at 1*s.* 10*d.* per pair. *Ans.* 6*l.* 12*s.*
64 gallons of brandy, at 9*s.* 6*d.* per gallon. *Ans.* 30*l.* 8*s.*
72 ells of diaper, at 1*s.* 4½*d.* per ell. *Ans.* 4*l.* 19*s.*
120 *lb.* of tea, at 5*s.* 9*d.* per *lb.* *Ans.* 34*l.* 10*s.*
144 *lb.* of sugar, at 1*s.* 3*d.* per *lb.* *Ans.* 9*l.*
132 yards of cloth, at 2*s.* 4*d.* per yard. *Ans.* 15*l.* 8*s.*

If the multiplier cannot be produced by the multiplication of two figures, then take the nearest number to it, and multiply as before, observing to multiply the top line by as many as is wanting, adding it to the last product.

EXAMPLES.

39 yards of tabby, at 9*s*. 7*d*. per yard.

	s.	*d.*	
	9	7×3	
		6	6×6+3=39
2	17	6	
		6	
17	5	—	
1	8	9	
£18	13	9	*Ans.*

127 *lb*. of bohea tea, at 12*s*. 3*d*. per *lb*. *Ans*. 77*l*. 15*s*. 9*d*.

117 *cwt*. of Malaga raisins, at 1*l*. 2*s*. 3*d*. per *cwt*.
Ans. 130*l*. 3*s*. 3*d*.

135 gallons of rum, at 7*s*. 5*d*. per gallon.
Ans. 50*l*. 1*s*. 3*d*.

97 *cwt*. of cheese, at 1*l*. 5*s*. 3*d*. per *cwt*.
Ans. 122*l*. 9*s*. 3*d*.

94 pair of silk stockings, at 12*s*. 2*d*. per pair.
Ans. 57*l*. 3*s*. 8*d*.

154 *cwt*. of tobacco, at 4*l*. 17*s*. 10*d*. per *cwt*.
Ans. 753*l*. 6*s*. 1*d*.

When the multiplier consists ½, ¼, divide the price by ½, ¼; when ¾, divide the price by ½, and that quotient by ½; which add to the product of the given quantity.

25½ ells of Holland, at 3*s*. 4½*d*. per ell.

		s.	*d.*
|½|2|		3	4½
			5
		16	10½
			5
	4	4	4½=25
	—	1	8¼= ½
	£4	6	0¾=25½

75½ ells

$75\frac{1}{2}$ ells of diaper, at 4*s.* 3*d.* per ell. *Ans.* 4*l.* 14*s.* $4\frac{1}{2}$*d.*

$117\frac{1}{4}$ gallons of arrack, at 12*s.* 6*d.* per gallon.
Ans. 73*l.* 5*s.* $7\frac{1}{2}$*d.*

$17\frac{3}{4}$ yards of superfine scarlet drab, at 1*l.* 3*s.* 6*d.* per yard.
Ans. 20*l.* 17*s.* $1\frac{1}{2}$*d.*

$56\frac{3}{4}$ *cwt.* of sugar, at 2*l.* 18*s.* 7*d.* per *cwt.*
Ans. 166*l.* 4*s.* $7\frac{1}{4}$*d.*

$96\frac{1}{2}$ *cwt.* of currants, at 2*l.* 15*s.* 6*d.* per *cwt.*
Ans. 267*l.* 15*s.* 9*d.*

EXAMPLES OF WEIGHTS AND MEASURES.

Multiply 8 lb. 5 oz. 17 dwt. 4 gr. by 8.
Multiply 76 yds. 3 qrs. 2 nails, by 5.
Multiply 25 tons, 7 cwt. 2 qrs. 3 lb. by 9.
Multiply 31 ale barrels, 2 firkins, 1 gallon, by 11.
Multiply 52 acres, 3 roods, 5 poles, by 4.
Multiply 34 beer barrels, 2 firkins, 7 gallons, by 7.
Multiply 81 miles, 2 furlongs, 21 poles, by 12.
Multiply 22 English ells, 3 quarters, 2 nails, by 6.

Division

of MONEY, WEIGHTS, and MEASURES.

Rule 1. Put the divisor and dividend as in division of integers.

2. Divide the first denomination on the left-hand, by the divisor, and write down the quotient.

3. If there be any remainder, multiply it by as many of the next less as make one of that, which add to the next less, if any, and divide as before.

4. Proceed thus, through all the denominations to the lowest, and the whole quotient will be the answer.

PROOF. By multiplication.

EXAMPLES OF MONEY.

Divide 374*l.* 14*s.* 6*d.* by 4.

	£.	s.	d.	
4)	374	14	6	
	£93	13	$7\frac{1}{2}$	*Ans.*

Divide 741*l.* 10*s.* 2*d.* by 7. *Ans.* 105*l.* 18*s.* 7*d.*

Divide 135*l.* 10*s.* 7*d.* by 9. *Ans.* 15*l.* 1*s.* 2*d.*

If a man spends 257*l.* 2*s.* 5*d.* in twelve month's time. What is that per month? *Ans.* 21*l.* 8*s.* 6¼*d.*

If I give 37*l.* 6*s.* 4¾*d.* for 9 pieces of cloth: what do I give per piece? *Ans.* 4*l.* 2*s.* 11*d.*

When the divisor is above 12, and is such a number, that any two figures multiplied together will produce that number; divide by them separately, as in division of integers.

EXAMPLES.

What is tea per *lb.* if 24*lb.* cost 9*l.* 11*s.* 4*d.*?

	£.	*s.*	*d.*	
6)	9	11	4	
4)	1	11	10½	
	0	7	11½	*Ans.*

The clothing of 35 charity boys came to 57*l.* 3*s.* 7*d.* What is the expence of each? *Ans.* 1*l.* 12*s.* 8*d.*

What is tobacco per *cwt.* if 20 *cwt.* cost 27*l* 5*s.* 4½*d.* *Ans.* 1*l.* 7*s.* 3*d.*

What is the value of 1 hogshead of beer, when 120 are sold for 154*l.* 17*s.* 10*d.*? *Ans.* 1*l.* 5*s.* 9¾*d.*

Bought 72 yards of cloth for 85*l.* 6*s.* I desire to know at what rate per yard? *Ans.* 1*l.* 3*s.* 8¼*d.*

Gave 275*l.* 3*s.* 4*d.* for 36 bales of cloth. What is that per bale? *Ans.* 7*l.* 16*s.* 2¼*d.*

A gentleman had 9625*l.* to distribute among 25 men. How much must each man have? *Ans.* 385*l.*

When the divisor cannot be produced by the multiplication of two figures, divide by the whole divisor, as in long division.

EXAMPLES.

A trader cleared 1157*l.* 17*s.* 4*d.* in 17 years. How much did he clear in a year?

£. s. d. £. s. d.

17)1157 17 4(68 2 2¼ *Ans.*

102

137

136

1

20

37

34

3

12

40

34

6

4

24

17

7 Rem.

A prize of 7257*l.* 3*s.* 6*d.* is to be equally divided among 525 men. What is each man's share?

Ans. 13*l.* 16*s.* 7¾*d.*

Paid 37 workmen for one week's work 23*l.* 15*s.* 7¼*d.* How much is each man's share? *Ans* 12*s.* 10¼*d.*

A gentleman spends 315*l* 3*s.* 10¼*d.* in 365 days. How much does he spend in a day? *Ans.* 17*s.* 3¼*d.*

Bought 26 *lb.* of tea for 14*l.* 12*s.* 6*d.* What did I give per *lb.* *Ans.* 11*s.* 3*d.*

EXAMPLES OF WEIGHTS AND MEASURES.

Divide 75 lb. 3 oz. 9 dwt. 14 gr. by 9.
Divide 24 tons. 12 cwt. 2 qrs. 14 lb. 9 oz. 12 gr. by 7.
Divide 74 yards, 2 quarters, 3 nails, by 11.
Divide 94 miles, 5 furlongs, 32 poles, by 5.
Divide 127 acres, 1 rood, 29 poles, by 31.
Divide 419 beer barrels, 2 firkins, 5 gallons, by 113.
Divide 312 months, 2 weeks, 3 days, 6 hours, 33 minutes, by 76.

BILLS OF PARCELS.

LEATHER-SELLERS.

Mr. Giles Harris,
Bought of Abel Smith, April 15, 1794.

		s.	d.		
27 Calf Skins.........	at	3	9	per skin	£
75 Sheep ditto........	at	1	7	———	
36 Coloured ditto....	at	1	8	———	
15 Buck ditto..........	at	11	6	———	
17 Russia Hides......	at	10	7	each	
120 Lamb Skins	at	1	2½	———	
					£38 17 5

GROCERS.

Mr. Richard Groves,
Bought of Francis Elliott, April 21, 1794.

		s.	d.		
25 *lb.* of Lump Sugar....	at	0	6½	per *lb.*	£
2 Loaves of double-refined, weight 15 *lb.*	at	0	11½	———	
14 *lb.* of Rice............	at	0	3	———	
28 *lb.* of Malaga Raisins..	at	0	5	———	
15 *lb.* of Currants	at	0	5½	———	
7 *lb.* of Black Pepper ...	at	1	10	———	
					£3 2 9½

CHEESE-MONGERS.

Mr. Charles Cross,

Bought of Samuel Grant, April 23, 1794.

		s.	*d.*		
8 *lb.* of Cambridge Butter	at	0	6	per *lb.*	£
17 *lb.* of new Cheese	at	0	4	——	
½ Firkin of Butter, wt. 28*lb.*	at	0	5½	——	
5 Cheshire Cheeses, wt. 127*lb.*	at	0	4	——	
2 Warwickshire do. wt. 15*lb.*	at	0	3	——	
12 *lb.* of Cream Cheese	at	0	6	——	
					£3 14 7

LINEN-DRAPERS.

Mr. Simon Surety,

Bought of Josiah Short, March 27, 1794.

		s.	*d.*		
4 Yards of Cambric	at	12	6	per yard	£
12 Yards of Muslin	at	8	3	——	
15 Yards of Printed Linen	at	5	4	——	
2 Dozen of Napkins	at	2	3	each	
14 Ells of Diaper	at	1	7	per ell	
35 Ells of Dowlass	at	1	1½	——	
					£17 4 6½

MILLINERS.

Mrs. Bright,

Bought of Lucy Brown, April 5, 1794.

		s.	*d.*		
18 Yards of fine Lace	at	12	3	per yard	£
5 Pair of fine Kid Gloves	at	2	2	per pair	
4 Doz. of Irish Lamb do.	at	1	3	——	
12 Fans and French mounts	at	3	6	each	
2 fine laced Tippets	at	63	0	——	
6 Sets of Knots	at	2	6	per set	
					£23 14 4

WOOLLEN-DRAPERS.

Mr. Thomas Sage,

Bought of Ellis Smith, April 7, 1794.

	s.	d.		£
17 Yards of fine Serge.....at	3	9	per yard	
18 Yards of Drugget ..... at	9	0	——	
15 Yards of superfine Scarlet at	22	0	——	
16 Yards of Black Cloth ..at	18	0	——	
25 Yards of Shalloon.......at	1	9	——	
17 Yards of Drab Cloth....at	17	6	——	
				£59 5 0

Reduction

Is the bringing numbers from one name to another, without changing their value.

Rule 1. Great names are reduced into small, by multiplying by as many of the next lower as make one of the greater, adding to this product the number, if any, which was in this lower denomination.

Rule 2. Proceed in the same manner through all the denominations, and the last number will be the answer, which will be equal in value to those in the higher name, put together.

1. Small names are brought into great, by dividing the given number by as many of that denomination, as make one of the next higher, setting down what remains.

2. Proceed thus, through all the denominations, to the highest, and the last quotient, together with their several remainders, if any, will be equal in value to the first number given.

EXAMPLES.

1. In 8*l.* 12*s.* 4¼*d.* How many farthings?

£. *s.* *d.*
8 12 4¼
20

172
12

2068
4

8273 *Answer.*

2. In 8273 farthings how many pounds?

4)8273

12)2068—¼

2,0)17,2—4

£8 12 4¼ *Answer.*

3. In 12*l.* how many farthings? *Ans.* 11520.
4. In 11520 farthings how many pounds? *Ans.* 12*l.*
5. In 35 guineas how many farthings? *Ans.* 35280.
6. In 17*l.* 5*s.* 3¼*d.* how many farthings? *Ans.* 16573.
7. In 16573 farthings how many pounds? *Ans.* 17*l.* 5*s.* 3¼*d.*
8. In 57 half-crowns, how many farthings? *Ans.* 6840.
9. In 900 pence, how many crowns? *Ans.* 15.
10. In 25*l.* 14*s.* 1*d.* how many pence? *Ans.* 6169.
11. In 6169 pence, how many pounds? *Ans.* 25*l.* 14*s.* 1*d.*
12. How many guineas in 21168 farthings? *Ans.* 21.
13. In 76 moidores, each 1*l.* 7*s.* how many pounds? *Ans.* 102*l.* 12*s.*
14. In 34 *ton*, 17 *cwt.* 1 *qr.* 19 *lb.* how many pounds? *Ans.* 78111.
15. In 2 ounces of gold, how many grains? *Ans.* 12960.

16. In 12960 grains of gold, how many ounces? *Ans.* 27.

17. In 27 yards, how many nails? *Ans.* 432.

18. In 93¾ yards, how many English ells? *Ans.* 75.

19. Bought 27 pieces of English stuffs, each 27 ells: how many yards? *Ans.* 911 *yds.* 1 *qr.*

20. In 27 acres, how many perches? *Ans.* 4320.

21. In 18240 poles, how many miles? *Ans.* 57.

22. Bought 5 tons of port wine: how many pints? *Ans.* 10080.

23. In 46 barrels of beer, how many pints? *Ans.* 13248.

24. In 30720 quarts of corn, how many quarters? *Ans.* 120.

25. How many days is it since the birth of our Saviour to Christmas 1789? *Ans.* 653432 *days*, 6 *hours.*

The Single Rule of Three Direct

Teaches, by three given numbers, to find a fourth, which must bear such proportion to the third, as the second does to the first.

RULE 1. Place the numbers in such order, that the first and third may be of one kind, and the second of the same kind as the number required.

2. If the first and third numbers consist of several denominations, reduce them into one name, and the second into the lowest term mentioned.

3. Multiply the second and third numbers together, and divide the product by the first, and the quotient will be the answer to the question, which will be in the same denomination you left the second number in.

EXAMPLES.

1. If 1 lb. of sugar cost 4½d. what cost 54 lb.?

1 : 4½ : : 54
4 18
Ans. 1*l.* 0*s.* 3*d.*
18 4)972
12)243
20s. 3d.

2. If a gallon of ale cost 3d. what is that per barrel? *Ans.* 8*s.*

3. If a pair of shoes cost 4s. 6d. what will 12 dozen come to? *Ans.* 32*l.* 8*s.*

4. If 12 dozen pair of stockings cost 32l. 8s. what is that per pair? *Ans.* 4*s.* 6*d.*

5. If 1 yard of cloth cost 15s. 6d. what will 32 yards cost at the same rate? *Ans.* 24*l.* 16*s.*

6. If 32 yards of cloth cost 24l. 16s. what is the value of 1 yard? *Ans.* 15*s.* 6*d.*

7. If 1 lb. of sugar cost 10½d. what is the worth of 1 cwt.? *Ans.* 4*l.* 18*s.*

8. If I gave 4l. 18s. for 1 cwt. of sugar, at what rate did I buy it at per lb.? *Ans.* 10½*d.*

9. If I buy 20 pieces of cloth, each 20 ells, for 12s. 6d. per ell, what is the value of the whole? *Ans.* 250*l.*

10. Bought 20 pieces of Holland, each 20 ells, for 250l. what is that per ell? *Ans.* 12*s.* 6*d.*

11. What will 25 cwt. 3 qrs. 14 lb. of tobacco come to, at 15½d. per lb. *Ans.* 187*l.* 3*s.* 3*d.*

12. I gave 187l. 3s. 3d. for 25 cwt. 3 qrs. 14 lb. of tobacco, at what rate did I buy it at per lb.? *Ans.* 15½*d.*

13. Bought 27¼ yds. of muslin, at 6s. 9½d. per yard, what does it amount to? *Ans.* 9*l.* 5*s.* 0¾*d.* 2 *rem.*

14. Bought 17 cwt. 1 qr. 14 lb. of iron, at 3¼d. per lb. what does it come to? *Ans.* 26*l.* 7*s.* 0½*d.*

15. If coffee is sold for 5½d. per ounce, what must be given for 2 cwt.? *Ans.* 82*l.* 2*s.* 8*d.*

16. How many yards of cloth may be bought for 21l. 11s. 1½d, when 3½ yards cost 2l. 14s. 3d.? *Ans.* 27 *yds.* 3 *qrs.* 1 *nail.* 42 *rem.*

17. If 3½ lb. of Cheshire cheese cost 1s. 1d. what cost 1 cwt.? *Ans.* 1*l.* 14*s.* 8*d.*

18. If 1 cwt. of Cheshire cheese cost 1l. 14s. 8d. what must I give for 3½ lb.? *Ans.* 1*s.* 1*d.*

19. Bought 1 cwt. 24 lb. 8 oz. of old lead, at 9s. per cwt. what does it come to? *Ans.* 10*s.* 11½*d.* 112 *rem.*

20. If 1 cwt. 24 lb. 8 oz. of lead be worth 10s. 11½d. $\frac{112}{224}$, what is that per cwt.? *Ans.* 9*s.*

21. If a gentleman's income is 500l. a year, and he

spends 19s. 4d. per day, how much does he lay by at the year's end? *Ans.* 147*l.* 3*s.* 4*d.*

22. If I buy 14 yards of cloth for 10 guineas, how many Flemish ells can I buy for 283l. 17s. 6d. at the same rate? *Ans.* 404 *Fl. ells.* 2 *qrs.*

23. If 283l. 17s. 6d. will buy 504 Flemish ells, 2 quarters, what quantity of yards can I have for 10l. 10s.? *Ans.* 14 *yds.*

24. If 504 Flemish ells, 2 qrs. cost 283l. 17s. 6d. at what rate must I give for 14 yards? *Ans.* 10*l.* 10*s.*

25. Gave 1l. 1s. 8d. for 3 lb. of coffee, what must be given for 29 lb. 4 oz.? *Ans.* 10*l.* 11*s.* 3*d.*

26. Bought 29 lb. 4 oz. of coffee, for 10l. 11s. 3d. what is the value of 3 lb.? *Ans.* 1*l.* 1*s.* 8*d.*

27. If 1½ oz. of coffee cost 6¼d. what will 3¼ oz. cost at the same rate? *Ans.* 1*s.* 1½*d.* 1 *rem.*

28. If 1 English ell, 2 qrs. cost 4s. 7d. what will 39½ yards cost at the same rate? *Ans.* 5*l.* 3*s.* 5¼*d.* 5 *rem.*

29. If 1 ounce of gold is worth 5l. 4s. 2d. what is the worth of 1 grain? *Ans.* 2½*d.* 20 *rem.*

30. If 14 yards of broad cloth cost 9l. 12s. what is the purchase of 75 yards? *Ans.* 51*l.* 8*s.* 6¾*d.* 6 *rem.*

31. If 27 yards of Holland cost 5l. 12s. 6d. how many ells English can I buy for 100l.? *Ans.* 384.

32. If 1 cwt. cost 12l. 12s. 6d. what must I give for 14 cwt. 1 qr. 19 lb.? *Ans.* 182*l.* 0*s.* 11½*d.* 8 *rem.*

33. Bought 7 yards of cloth for 17s. 8d. what must be given for 5 pieces, each containing 27½ yards? *Ans.* 17*l.* 7*s.* 0¼*d.* 2 *rem.*

34. If 7 oz. 11 dwts. of gold be worth 35l. what is the value of 14 lb. 9 oz. 12 dwts. 16 gr. at the same rate? *Ans.* 823*l.* 9*s.* 3¾*d.* 552 *rem.*

35. A draper bought 420 yards of broad cloth, at the rate of 14s. 10¾d. per ell English, how much did he pay for the whole? *Ans.* 250*l.* 5*s.*

36. A gentleman bought a wedge of gold, which weighed 14 lb. 3 oz. 8 dwts. for the sum of 514l. 4s. at what rate did he pay for it per oz.? *Ans.* 3*l.*

37. A grocer bought 4 hogsheads of sugar, each weighing neat 6 cwt. 2 qrs. 14 lb. which cost him 2l. 8s. 6d. per

cwt. what is the value of the 4 hogsheads? *Ans.* 64*l.* 5*s.* 3*d.*

38. A draper bought 8 packs of cloth, each containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and gave after the rate of 4l. 16s. for 6 yards, I desire to know what the 8 packs stood him in? *Ans.* 6656*l.*

39. If 24 lb. of raisins cost 6s. 6d. what will 18 frails cost, each weighing neat 3 qrs. 18 lb.? *Ans.* 24*l.* 17*s.* 3*d.*

40. If 1 ounce of silver be worth 5s. what is the price of 14 ingots, each weighing 7 lb. 5 oz. 10 dwt.? *Ans.* 313*l.* 5*s.*

41. What is the price of a pack of wool weighing 2 cwt. 1 qr. 19 lb. at 8s. 6d. per stone? *Ans.* 8*l.* 4*s.* 6¼*d.* 10 *rem.*

42. Bought 59 cwt. 2 qrs. 24 lb. of tobacco at 2l. 17s. 4d. per cwt. what does it come to? *Ans.* 171*l.* 3*s.* 7¼*d.* 80 *rem.*

43. What is the half-year's rent of 547 acres of land, at 15s. 6d. per acre per annum? *Ans.* 211*l.* 19*s.* 3*d.*

44. Bought 171 tons of lead, at 14l. per ton, paid carriage and other incident charges 4l. 10s. I require the value of the lead, and what it stands me in per lb.
Ans. 2398*l.* 10*s.* *Value* 1½*d.* 432 *rem. per lb.*

45. If a pair of stockings cost 10 groats, how many dozen may I buy for 43l. 5s.? *Ans.* 21 *doz.* 7½ *pair.*

46. Bought 27 dozen, 5 lb. of candles, after the rate of 17d. per 3 lb. what did they cost me?
Ans. 7*l.* 15*s.* 4¼*d.* 1 *rem.*

47. If an ounce of fine gold is sold for 3l. 10s. what comes 7 ingots to, each weighing 3 lb. 7 oz. 14 dwt. 21 gr. at the same price? *Ans.* 1071*l.* 14*s.* 5¼*d.*

48. If my horse stands me in 9½d. per day keeping, what will be the charge of 11 horses for the year?
Ans. 158*l.* 18*s.* 6½*d.*

49. A factor bought 86 pieces of stuff, which cost him 517l. 19s. 4d. at 4s. 10d. per yard, I demand how many yards there were, and how many ells English in a piece? *Ans.* 2143¾ *yards.* 14 *rem.*
and 19 *ells,* 4 *quarters,* 2 *nails.* 64 *rem. in a piece.*

50. A gentleman hath an annuity of 896l. 17s. per annum, I desire to know how much he may spend daily, that at the year's end he may lay up 200 guineas, and give the poor quarterly 10 moidores? *Ans.* 1*l.* 14*s.* 8*d.* 44 *rem.*

The Rule of Three Inverse.

Inverse Proportion is, when more requires less, and less requires more. More requires less, is when the third term is greater than the first, and requires the fourth term to be less than the second. And less requires more, is when the third term is less than the first, and requires the fourth term to be greater than the second.

Rule. Multiply the first and second terms together, and divide the product by the third; the quotient will bear such proportion to the second as the first does to the third.

EXAMPLES.

1. If 8 men can do a piece of work in 12 days, how many days can 16 men perform the same? *Ans.* 6 *days.*

8 : 12 : 16 : 6
8
16)96(6 *days.*

2. If 54 men can build a house in 90 days, how many men can do the same in 50 days? *Ans.* $97\frac{1}{5}$ *men.*

3. If, when a peck of wheat is sold for 2s. the penny loaf weighs 8 oz. how much will it weigh when the peck is worth but 1s. 6d.? *Ans.* 10 *oz.* $10\frac{2}{3}$ *dr.*

4. How many pieces of money of 20s. value are equal to 240 pieces of 12s. each.? *Ans.* 144.

5. How many yards of three quarters wide are equal in measure to 30 yards of five quarters wide? *Ans.* 50.

6. If I lend my friend 200l. for 12 months, how long ought he to lend me 150l. to requite my kindness? *Ans.* 16 *months.*

7. If for 24s. I have 1200 lb. carried 36 miles, how many pounds can I have carried 24 miles for the same money? *Ans.* 1800 *lb.*

8. If 100 workmen finish a piece of work in 12 days, how many are sufficient to finish it in 3 days? *Ans.* 400.

9. An army besieging a town, in which were 1000 soldiers, with provisions for 3 months, how many sol-

diers departed, when the provisions lasted them 6 months? *Ans.* 500.

10. If 20l. worth of wine is sufficient to serve an ordinary of 100 men, when the tun is sold for 30l. how many will 20l. worth suffice, when the tun is sold but for 24l.? *Ans.* 125 *men.*

11. A courier makes a journey in 24 days, when the day is but 12 hours long: how many days will he be going the same journey, when the days are 16 hours long? *Ans.* 18 *days.*

12. How much plush is sufficient for a cloak, which has in it but 4 yards of 7 quarters wide of stuff for the lining, the plush being 3 quarters wide? *Ans.* 9⅓ *yards.*

13. If 14 pioneers make a trench in 18 days, how many days will 34 take to do the same?
Ans. 7 *days*, 4 *hours*, 56 *minutes*, 16 *rem.*

14. Borrowed of my friend 64l. for 8 months, and he hath occasion another time to borrow of me for 12 months: How much must I lend him to requite his former kindness to me? *Ans.* 42*l.* 13*s.* 4*d.*

15. A regiment of soldiers, consisting of 1000 men, are to have new coats, each coat to contain 2½ yards of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide, I demand how many yards of shalloon will line them? *Ans.* 4166 *yards*, 2 *quarters*, 2 *nails*, 2 *rem.*

The Double Rule of Three

Is so called, because it is composed of 5 numbers given to find a 6th, which, if the proportion is direct, must bear such proportion to the 4th and 5th, as the 3d bears to the 1st and 2d. But if inverse, the 6th number must bear such proportion to the 4th and 5th, as the 1st bears to the 2d and 3d. The three first terms are a supposition; the two last a demand.

RULE 1. Let the principal cause of loss or gain, interest or decrease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place, and the like, be in the second place, and the remaining one in the third.

3. Place the other two terms under their like, in the supposition.

4. If the blank falls under the third term, multiply the first and second terms for a divisor, and the other three for a dividend. But,

5. If the blank falls under the first or second term, multiply the third and fourth terms for a divisor, and the other three for the dividend, and the quotient will be the answer.

Proof. By two single rules of three.

EXAMPLES.

1. If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses for 24 days?

By two single rules.	*or in one stating.*	*Worked thus,*
hor. bu. hor. bu.	*hor. days. bu.*	
1. *As* 14 : 56 : : 20 : 80	14 : 16 : 56	$\frac{56\times20\times24}{14\times16}=120$
days. bu. days. bu.	20 : 24 : —	
2. *As* 16 : 80 : : 24 : 120		

2. If 8 men in 14 days can mow 112 acres of grass, how many men must there be to mow 2000 acres in 10 days?

acres. days. acres. days.	*men. days. acres.*	
1. *As* 112 : 14 : : 2000 : 250	8 : 14 : 112	$\frac{8\times14\times2000}{112\times10}=200$
days. men. days. men.		
2. *As* 250 : 8 : : 10 : 200	— : 10 : 2000	

3. If 100l. in 12 months, gain 6l. interest, how much will 75l. gain in 9 months? *Ans.* 3*l.* 7*s.* 6*d.*

4. If a carrier receives 2l. 2s. for the carriage of 3 cwt. 150 miles, how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. for 50 miles?
Ans. 1*l.* 16*s.* 9*d.*

5. If a regiment of soldiers, consisting of 136 men, consume 351 quarters of wheat in 108 days, how many quarters of wheat will 11232 soldiers consume in 56 days? *Ans.* 15031.

6. If 40 acres of grass be mowed by 8 men in 7 days, how many acres can be mowed by 24 men in 28 days? *Ans.* 480.

7. If 40s. will pay 8 men for 5 days work, how much will pay 32 men for 24 days work? *Ans.* 38*l.* 8*s.*

8. If 100l. in 12 months, gain 6l. interest, what principal will gain 3l. 7s. 6d. in 9 months? *Ans.* 75*l.*

9. If a regiment, consisting of 939 soldiers, consume 351 quarters of wheat in 168 days, how many soldiers will consume 1404 quarters in 56 days? *Ans.* 11268.

10. If in a family, consisting of 7 persons, there are drank out 2 kildrkins of beer in 12 days, how many kilderkins will there be drank out by another family of 14 persons in 8 days? *Ans.* 2 *kil.* 12 *gal.*

11. If the carriage of 60 cwt. 20 miles, cost 14l. 10s. what weight can I have carried 30 miles, for 5l. 8s. 9d. at the same rate of carriage? *Ans.* 15 *cwt.*

12. If 2 horses eat 8 bushels of oats in 16 days, how many horses will eat up 3000 quarters in 24 days? *Ans.* 4000.

13. If 100l. in 12 months, gain 7l. interest, what is the interest of 571l. for 6 years? *Ans.* 239*l.* 16*s.* 4$\frac{3}{4}$*d.*

14. If I pay 10s. for the carriage of 2 tons, 6 miles, what must I pay for the carriage of 12 tons, 17 cwt. 17 miles? *Ans.* 9*l.* 2*s.* 0$\frac{1}{2}$*d.*

Practice

Is so called, from the general use thereof by all persons concerned in trade and business.

All questions in this rule are performed by taking aliquot or even parts, by which means many tedious reductions are avoided; the table of which is as follows:

Of a Pound. s. d.		*Of a Shilling.* d.		*Of a Ton.* cwt.		*Of an Hund.* qrs. lb.	
10 0 is	$\frac{1}{2}$	6 is	$\frac{1}{2}$	10 is	$\frac{1}{2}$	2 or 56 is	$\frac{1}{2}$
6 8 —	$\frac{1}{3}$	4 —	$\frac{1}{3}$	5 —	$\frac{1}{4}$	1 — 28 —	$\frac{1}{4}$
5 0 —	$\frac{1}{4}$	3 —	$\frac{1}{4}$	4 —	$\frac{1}{5}$	14 —	$\frac{1}{8}$
4 0 —	$\frac{1}{5}$	2 —	$\frac{1}{6}$	$2\frac{1}{2}$ —	$\frac{1}{8}$	*Of a Quarter.*	
3 4 —	$\frac{1}{6}$	$1\frac{1}{2}$ —	$\frac{1}{8}$	2 —	$\frac{1}{10}$	14 —	$\frac{1}{2}$
2 6 —	$\frac{1}{8}$	1 —	$\frac{1}{12}$			7 —	$\frac{1}{4}$
2 0 —	$\frac{1}{10}$					4 —	$\frac{1}{7}$
1 8 —	$\frac{1}{12}$					$3\frac{1}{2}$ —	$\frac{1}{8}$

RULE 1. When the price is less than a penny, divide by the aliquot parts that are in a penny; then by 12 and 20, it will be the answer.

$\frac{1}{4}$ is $\frac{1}{4}$ 5704lb. at $\frac{1}{4}$

12)1426

2|0)11|8 10

£5 18 10

7695 at $\frac{1}{2}$
facit £16 0 $7\frac{1}{2}$

5740 at $\frac{1}{2}$
facit £11 19 2

6547 at $\frac{3}{4}$
facit £20 9 $2\frac{1}{4}$

4573 at $\frac{3}{4}$
facit £14 5 $9\frac{3}{4}$

RULE 2. When the price is less than a shilling, take the aliquot part or parts that are in a shilling, add them together, and divide by 20, as before.

1 is $\frac{1}{12}$ 7547 at 1d.

2|0)62|8 11

£31 8 11

1 is $\frac{1}{12}$ 3751 at $1\frac{1}{4}$d.

$\frac{1}{4}$ is $\frac{1}{4}$) 312 7
78 $1\frac{3}{4}$

2|0)39|0 $8\frac{3}{4}$

£19 10 $8\frac{3}{4}$

54325 at $1\frac{1}{2}$d.
facit £339 10 $7\frac{1}{2}$

6254 at $1\frac{3}{4}$d.
facit £45 12 $0\frac{1}{2}$

2351 at 2d.
facit £19 11 10

7210 at $2\frac{1}{4}$d.
facit £67 11 $10\frac{1}{2}$

2710 at $2\frac{1}{4}$d.
facit £28 4 7

3250 at $2\frac{3}{4}$d.
facit £37 4 $9\frac{1}{2}$

2715 at 3d.
facit £33 18 9

7062 at $3\frac{1}{4}$
facit £95 12 $7\frac{1}{2}$

2147 at $3\frac{1}{2}$d.
facit £31 6 $2\frac{1}{2}$

7000 at $3\frac{3}{4}$d.
facit £109 7 6

3257 at 4d.
facit £54 5 8

2056 at $4\frac{1}{4}$d.
facit £36 8 2

3752 at $4\frac{1}{2}$d.
facit £70 7 0

2107 at 4¾d. *facit* £41 14 0¼	3254 at 7¼d. *facit* £98 5 11½	2150 at 9¾d. *facit* £87 6 10½
3210 at 5d. *facit* £66 17 6	2701 at 7½d. *facit* £84 8 1½	6325 at 10d. *facit* £263 10 10
2715 at 5¼d. *facit* £59 7 9¾	3714 at 7¾d. *facit* £119 18 7½	5724 at 10¼d. *facit* £244 9 3
3120 at 5½d. *facit* £71 10 0	2710 at 8d. *facit* £90 6 8	6327 at 10¼d. *facit* £270 4 3¾
7521 at 5¾d. *facit* £180 3 9¾	3514 at 8¼d. *facit* £120 15 10½	3254 at 10½d. *facit* £142 7 3
3271 at 6d. *facit* £81 15 6	2759 at 8½d. *facit* £97 14 3½	7291 at 10¾d. *facit* £326 11 6¼
7914 at 6¼d. *facit* £206 1 10½	9872 at 8¾d. *facit* £359 18 4	3256 at 11d. *facit* £149 4 8
3250 at 6½d. *facit* £88 0 5	5272 at 9d. *facit* £197 14 0	7254 at 11¼d. *facit* £340 0 7½
2708 at 6¾d. *facit* £76 3 3	6325 at 9¼d. *facit* £243 15 6¼	3754 at 11½d. *facit* £179 17 7
3271 at 7d. *facit* £95 8 1	7924 at 9½d. *facit* £313 13 2	7972 at 11¾d. *facit* £390 5 11

RULE 3. When the price is more than one shilling, and less than two, take the part or parts, with so much of the given price as is more than a shilling, which add to the given quantity, and divide by 20, it will give the answer.

¼ 1/48 2106 at 12¼d. 43 10½ 2|0)214|9 10½ £107 9 10½	½ 1/24 3715 at 12½d. 154 9½ 2|0)386|9 9½ £193 9 9½	2712 at 12¾d. *facit* £144 1 6 2107 at 1s. 1d. *facit* £114 2 7

3215 at 1s. 1¼d.
facit £177 9 10¾

2790 at 1s. 1½d.
facit £156 18 9

7904 at 1s. 1¾d.
facit £452 16 8

3750 at 1s. 2d.
facit £218 15 0

3291 at 1s. 2¼d.
facit £195 8 0¾

9254 at 1s. 2½d.
facit £559 1 11

7250 at 1s. 2¾d.
facit £445 11 5½

7591 at 1s. 3d.
facit £474 8 9

6325 at 1s. 3¼d.
facit £401 18 0¼

5271 at 1s. 3½d.
facit £340 8 4½

3254 at 1s. 3¾d.
facit £213 10 10½

2915 at 1s. 4d.
facit £194 6 8

3270 at 1s. 4¼d.
facit £221 8 1½

7059 at 1s. 4½d.
facit £485 6 1½

2750 at 1s. 4¾d.
facit £191 18 6½

3725 at 1s. 5d.
facit £263 17 1

7250 at 1s. 5¼d.
facit £521 1 10½

2597 at 1s. 5½d.
facit £189 7 3½

7210 at 1s. 5¾d.
facit £533 4 9½

7524 at 1s. 6d.
facit £564 6 0

7103 at 1s. 6¼d.
facit £540 2 5¾

3254 at 1s. 6½d.
facit £250 16 7

7925 at 1s. 6¾d.
facit £619 2 9¾

9271 at 1s. 7d.
facit £733 19 1

7210 at 1s. 7¼d.
facit £578 6 0½

2310 at 1s. 7½d.
facit £187 13 9

2504 at 1s. 7¾d.
facit £206 1 2

7152 at 1s. 8d.
facit £596 0 0

2905 at 1s. 8¼d.
facit £245 2 2½

7104 at 1s. 8½d.
facit £606 16 0

1004 at 1s. 8¾d.
facit £86 16 1

2104 at 1s. 9d.
facit £184 2 0

2571 at 1s. 9¼d.
facit £227 12 9¾

2104 at 1s. 9½d.
facit £188 9 8

7506 at 1s. 9¾d.
facit £680 4 7½

1071 at 1s. 10d.
facit £98 3 6

5200 at 1s. 10¼d.
facit £482 1 8

2117 at 1s. 10½d.
facit £198 9 4½

1007 at 1s. 10¾d.
facit £95 9 1¼

5000 at 1s. 11d. *facit* 479 3 4	1006 at 1s. 11½d. *facit* £98 10 1	5000 at 1s. 11¼d. *facit* £489 11 8
2105 at 1s. 11¼d. *facit* £203 18 5¼	2705 at 1s. 11¾d. *facit* £267 13 7½	4000 at 1s. 11¾d. *facit* £395 16 8

Rule 4. When the price consists of any even number of shillings under 20, multiply the given quantity by half the price, doubling the first figure of the product for shillings, and the rest of the product will be pounds.

2750 at 2s. *facit* £275 0 0	2102 at 10s. *facit* 1051 0 0	1075 at 16s. *facit* £860 0 0
3254 at 4s. *facit* £650 16 0	2101 at 12s. *facit* £1260 12 0	1621 at 18s. *facit* £1458 18 0
2710 at 6s. *facit* £813 0 0	5271 at 14s. *facit* £3689 14 0	☞ *When the price is 10s. take half of the quantity, and if any remains, it is 10s.*
1572 at 8s. *facit* £628 16 0	3123 at 16s. *facit* £2498 8 0	

Rule 5. When the price consists of odd shillings, multiply the given quantity by the price, and divide by 20, the product will be the answer.

2703 at 1s. *facit* £135 3 0	2715 at 7s. *facit* £950 5 0	2150 at 15s. *facit* £1612 10 0
3270 at 3s. 3 2|0)981|0 £490 10 0	3214 at 9s. *facit* £1446 6 0	3142 at 17s. *facit* £2670 14 0
	2710 at 11s. *facit* £1490 10 0	2150 at 19s. *facit* £2042 10 0
3271 at 5s. *facit* £817 15 0	3179 at 13s. *facit* £2066 7 0	7157 at 19s. *facit* £6799 3 0

☞ *When the price is 5s. divide the quantity by 4, and if any remains it is 5s.*

RULE 6. When the price is shillings and pence, and they the aliquot part of a pound, divide by the aliquot part, and it will give the answer at once; but if they are not an aliquot part, then multiply the quantity by the shillings, and take parts of the rest, add them together, and divide by 20.

s. d.		
6 8	$\frac{1}{3}$	2710 at 6s. 8d.
		£903 6 8
		3150 at 3s. 4d. *facit* £525 0 0
		2715 at 2s. 6d. *facit* £339 7 6
		7150 at 1s. 8d. *facit* £595 16 8
		3215 at 1s. 4d. *facit* £214 6 8
		7211 at 1s. 3d. *facit* £450 13 9
d. 2	$\frac{1}{6}$	2710 at 3s. 2d. 3
		8130 451 8
	2|0	858|1 8
		£429 1 8
		7514 at 4s. 7d. *facit* £1721 19 2

2517 at 5s. 3d.
facit £660 14 3

2547 at 7s. $3\frac{1}{2}$d.
facit £928 11 $10\frac{1}{2}$

3271 at 5s. $9\frac{1}{4}$d.
facit £943 16 $4\frac{3}{4}$

2103 at 15s. $4\frac{1}{2}$d.
facit £1616 13 $7\frac{1}{2}$

7152 at 17s. $6\frac{3}{4}$d.
facit £6280 7 0

2510 at 14s. $7\frac{1}{4}$d.
facit £1832 16 $5\frac{1}{2}$

3715 at 9s. $4\frac{1}{2}$d.
facit £1741 8 $1\frac{1}{2}$

2572 at 13s. $7\frac{1}{2}$d.
facit £1752 3 6

7251 at 14s. $8\frac{1}{4}$d.
facit £5324 19 $0\frac{3}{4}$

3210 at 15s. $7\frac{3}{4}$d.
facit £2511 3 $1\frac{1}{2}$

2710 at 19s. $2\frac{1}{2}$d.
facit £2602 14 7

RULE 7. 1st. When the price is pounds and shillings, multiply the quantity by the pounds, and proceed with the shillings, if they are even, as in the 4th rule; if odd, take the aliquot parts, add them together, the sum will be the answer.

2dly. When pounds, shillings, and pence, and the shillings and pence the aliquot parts of a pound, multiply the quantity by the pounds, and take parts for the rest.

3dly. When the price is pounds, shillings, pence, and farthings, and the shillings and pence not the aliquot parts of a pound, reduce the pounds and shillings into shillings, multiply the quantity by the shillings, take parts for the rest, add them together, and divide by 20.

☞ *When the given quantity is no more than three figures, proceed as in* Compound Multiplication.

4	$\frac{1}{5}$	7215 at 7l. 4s.
		7
		50505
		1443
		51948 l.
s. d.		
2 6	$\frac{1}{8}$	2104 at 5l. 3s.
		5
		10520
		263
6	$\frac{1}{5}$	52 12
		10835 12 0
		2107 at 2l. 8s.
		facit £5056 16 0
		7156 at 5l. 6s.
		facit £37926 16 0

6	$\frac{1}{2}$	2710 at 2l. 3s. 7½d.
		43
		116530
1½	$\frac{1}{4}$	1355
		338 9
	2|0	11822|3 9
		£5911 3 9
		3215 at 1l. 17s.
		facit £5947 15 0
		2107 at 1l. 13s.
		facit £3476 11 0
		3215 at 4l. 6s. 8d.
		facit £13931 13 4
		2154 at 7l. 1s. 3d.
		facit £15212 12 6

2701 at 2l. 3s. 4d. *facit* £5852 3 4	142 at 1l. 15s. 2¾d. *facit* £250 2 6½
2715 at 1l. 17s. 2½d. *facit* £5051 0 7½	95 at 15l. 14s. 7¼d. *facit* £1494 7 4¾
2157 at 3l. 15s. 2¼d. *facit* £8108 19 5¼	37 at 1l. 19s. 5¾d. *facit* £73 0 8¾
3210 at 1l. 18s. 6¾d. *facit* £6189 5 7½	2175 at 2l. 15s. 4½d. *facit* £6022 0 7½
2157 at 2l. 7s. 4½d. *facit* £5109 7 10½	2150 at 17l. 16s. 1½d. *facit* £38283 8 9

RULE 8. When the price and quantity given are of several denominations, multiply the price by the integers, and take part with the parts of the integers for the rest.

1. At 3l. 17s. 6d. per cwt. what is the value of 25 cwt. 2 qrs. 14 lb. of tobacco?

```
qrs.
 2  | ½ |£ 3 : 17 :  6        5×5=25
    |   |             5
    |   |  ----------------
    |   |   19 :  7 :  6
    |   |             5
    |   |  ----------------
lb. |   |   96 : 17 :  6
 14 | ¼ |    1 : 18 :  9
    |   |          9 :  8¼
    |   |  ----------------
    |   |   99 :  5 : 11¼
```

2. At 1l. 4s. 9d. per cwt. what comes 17 cwt. 1 qr. 17 lb. of cheese to? *Ans.* 21*l.* 10*s.* 8*d.*

3. Sold 85 cwt. 1 qr. 10 lb. of cheese, at 1l. 7s. 8d. per cwt. what does it come to? *Ans.* 118*l.* 1*s.* 0½*d.*

4. Hops at 4l. 5s. 8d. per cwt. what must be given for 72 cwt. 1 qr. 18 lb.? *Ans.* 310*l.* 3*s.* 2*d.*

5. At 1l. 1s. 4d. per cwt. what is the value of 27 cwt. 2 qrs. 15 lb. of Malaga raisins? *Ans.* 29*l.* 9*s.* 6$\frac{1}{4}$*d.*

6. Bought 78 cwt. 3 qrs. 12 lb. of currants, at 2*l.* 17*s.* 9*d.* per cwt. what did I give for the whole? *Ans.* 227*l.* 14*s.*

7. Sold 56 cwt. 1 qr. 17 lb. of sugar, at 2l. 15s. 9d. the cwt. what does it come to? *Ans.* 157*l.* 4*s.* 4$\frac{1}{2}$*d.*

8. Tobacco at 3l. 17s. 10d. the cwt. what is the worth of 97 cwt. 15 lb.? *Ans.* 378*l.* 0*s.* 3*d.*

9. At 4l. 14s. 6d. the cwt. what is the value of 37 cwt. 2 qrs, 13 lb. of double-refined sugar? *Ans.* 177*l.* 14*s.* 8$\frac{1}{2}$*d.*

10. Bought sugar at 3l. 14s. 6d. the cwt. what did I give for 15 cwt. 1 qr. 10 lb.? *Ans.* 57*l.* 2*s.* 9*d.*

11. At 4l. 15*s.* 4d. the cwt. the value of 172 cwt. 3qr. 12 lb. of tobacco is required? *Ans.* 823*l.* 19*s.* 0$\frac{1}{4}$*d.*

12. Soap at 3l. 11s. 6d. the cwt. what is the value of 53 cwt. 17 lb.? *Ans.* 190*l.* 0*s.* 4*d.*

Interest.

INTEREST IS EITHER SIMPLE OR COMPOUND.

SIMPLE INTEREST

Is the *profit* allowed in lending or forbearance of any sum of money, for a determined space of time.

The *principal* is the money lent, for which interest is to be received.

The *rate per cent.* is a certain sum agreed on between the borrower and the lender, to be paid for every 100l. for the use of the principal 12 months.

The *amount* is the principal and interest added together.

Interest is also applied to commission, brokage, purchasing of stocks, and insurance.

To find the interest of any sum of money for a year.

Rule. Multiply the principal by the rate per cent. that product, divided by 100, will give the interest required.

For several years.

Rule. Multiply the interest of one year by the number of years given in the question, and the product will be the answer.

EXAMPLES.

1. What is the interest of 375l. for a year, at 5 per cent. per annum?

375
5
18|75
20
15|00 *Ans.* 18*l.* 15*s.*

2. What is the interest of 268l. for one year, at 4 per cent per annum? *Ans.* 10*l.* 14*s.* 4¾*d.*

3. What is the interest of 945l. 10s. for a year, at 4 per cent. per annum? *Ans.* 37*l.* 16*s.* 4¾*d.*

4. What is the interest of 547*l.* 15*s.* at 5 per cent. per annum, for 3 years? *Ans.* 82*l.* 3*s.* 3*d.*

5. What is the interest of 254l. 17s. 6d. for 5 years, at 4 per cent. per annum? *Ans.* 50*l.* 19*s.* 5¼*d.*

6. What is the interest of 556l. 13s. 4d. at 5 per cent. per annum, for 5 years? *Ans.* 139*l.* 3*s.* 4*d.*

COMMISSION

Is an allowance from merchants to their factors or correspondents, in the buying or selling of goods, and is generally at a certain rate per cent. according to the custom of the country where the factor resides.

Rule. Multiply the principal by the rate per cent. as before; and for ¼, ½, or ¾, take the part or parts from the principal, which added to the product, and divided by 100, will give the answer.

7. What is the commission of 287l. 10s. at 3½ per cent.

½ ½, 287 : 10
3 *Ans.* 10*l.* 1*s.* 3*d.*

862 : 10=3
143 : 15=½

10|06 : 5=3½
20

1|25
12

3|00

8. What must I allow my correspondent for disbursing on my account 529l. 18s. 5d. at 2¼ per cent?

Ans. 11*l.* 18*s.* 5½*d.*

9. My correspondent writes me word, that he has bought goods to the amount of 754l. 16s. on my account, what does his commission come to at 2½ per cent.?

Ans. 18*l.* 17*s.* 4¾*d.*

10. If I allow my factor 3¾ per cent. for commission, what may he demand on the laying out 876l. 5s. 10d.?

Ans. 32*l.* 17*s.* 2½*d.*

PURCHASING OF STOCKS.

Rule. Multipliy the sum to be purchased by the excess, above 100; divide that product by 100, the produce of which, added to the given sum, is the purchase required.

If under par (that is, under 100l.) multiply by the rate per cent. that product, divided by 100, gives the purchase thereof.

11. What is the purchase of 575l. 10s. bank stock, at $131\frac{3}{4}$ per cent.?

$6 \times 5 + 1 = 31$

575 : 10
6

3453
5

17265 : 0 : 0=30
$\frac{1}{2}$ $\frac{1}{2}$ 575 : 10 : 0= 1
$\frac{1}{4}$ $\frac{1}{2}$ 287 : 15 : 0= $\frac{1}{2}$
143 : 17 : 6= $\frac{1}{4}$

182|72 : 2 : 6=$31\frac{3}{4}$
20

14|42
12

5|10
575 : 10 : 0
182 : 14 : 5

£758 : 4 : 5 *Answer.*

12. What is the purchase of 254l. 17s. bank annuities, at $97\frac{1}{4}$ per cent.?

$12 \times 8 + 1 = 97$

254 : 17
12

3058 : 4
8

24465 : 12 : 0=96
$\frac{1}{4}$ $\frac{1}{4}$ 254 : 17 : 0= 1
63 : 14 : 3= $\frac{1}{4}$

247|84 : 3 : 3=$97\frac{1}{4}$
20

16|83
12

9|99
4

3|96

247*l.* 16*s.* $9\frac{3}{4}$*d.* *Answer.*

13. At $110\frac{1}{4}$ per cent. what is the purchase of 2054l. 16s. South-Sea stock? *Ans.* 2265*l.* 8*s.* 4*d.*

14. At $104\frac{3}{8}$ per cent. South-Sea annuities, what is the purchase of 1797l. 14s.? *Ans.* 1876*l.* 6*s.* $11\frac{3}{4}$*d.*

15. What is the purchase of 2750l. 17s. South-Sea old annuities, at $102\frac{5}{8}$ per cent.? *Ans.* 2823*l.* 1*s.* $2\frac{1}{4}$*d.*

16. At $96\frac{3}{4}$ per cent. what is the purchase of 577l. 19s. Bank annuities? *Ans.* 559*l.* 3*s.* $3\frac{3}{4}$*d.*

17. At $124\frac{5}{8}$ per cent. what is the purchase of 758l. 17s. 10d. India stock? *Ans.* 945*l.* 15*s.* $4\frac{1}{4}$*d.*

BROKAGE

Is an allowance to brokers, for helping merchants or factors to persons to buy or sell them goods.

Rule. Divide the sum given by 100, and take parts from the quotient with the rate per cent.

18. If I employ a broker to sell goods for me, to the value of 2575l. 17s. 6d. what is the brokage at 4s. per cent.?

25|75 : 17 : 6
20
15|17
12
2|10

4s. $\frac{1}{5}$ 25 : 15 : 2
Answer £5 : 3 : 0$\frac{1}{4}$

19. What is the brokage of 796l. 14s. 7d. at 6s. per cent.? *Ans.* 2*l.* 7*s.* 9$\frac{1}{2}$*d.*

20. When a broker sells goods to the amount of 7105l. 5s. 10d. what may he demand for brokage, if he is allowed 5s. 6d. per cent.? *Ans.* 19*l.* 10*s.* 9$\frac{1}{4}$*d.*

21. If a broker is employed to buy a quantity of goods, to the value of 975l. 6s. 4d. what is the brokage at 6s. 6d. per cent.? *Ans.* 3*l.* 3*s.* 4$\frac{1}{2}$*d.*

When the time is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a year, besides a number of years given.

Rule. Take parts of the interest for one year, which add to the interest of the several years given, and it will give the answer.

22. What is the interest of 554l. 10s. for 3 months, at 4 per cent. per annum?

554 : 10
4
22|18 : 0
20
3|60
12
7|20
m. 3 $\frac{1}{4}$ 22 : 3 : 7
Ans. 5 : 10 : 10$\frac{1}{4}$

23. What is the interest of 336l. 15s. 6d. for 2$\frac{1}{4}$ years, at 5 per cent. per annum?

336 : 15 : 6
5
1683 : 17 : 6
20
16|77
12
9|30
4
1|20

16 : 16 : 9$\frac{1}{4}$
2
33 : 13 : 6$\frac{1}{2}$
$\frac{1}{2}$ $\frac{1}{2}$ 8 : 8 : 4$\frac{1}{2}$
$\frac{1}{4}$ $\frac{1}{2}$ 4 : 4 : 2$\frac{1}{4}$
Ans. 46 : 6 : 1$\frac{1}{4}$

24. What is the interest of 325l. 7s. 6d. at 6 per cent. per annum, for 3½ years? *Ans.* 68*l.* 6*s.* 6¼*d.*

25. What is the interest of 547l. 2s. 4d. for 5½ years, at 4 per cent. per annum? *Ans.* 120*l.* 7*s.* 3¼*d.*

26. What is the interest of 257l. 5s. 1d. at 4 per cent. for a year and three quarters? *Ans.* 18*l.* 0*s.* 1½*d.*

27. What is the interest of 479l. 5s. for 5¼ years, at 5 per cent. per annum? *Ans.* 125*l.* 16*s.* 0¾*d.*

When the rate per cent. is ¼, ½, or ¾, *more than the pounds given in the rate*, proceed as in Commission, and it will give the answer for one year; and for several, proceed as in the last rule.

28. What is the interest of 175l. 17s. for 2¾ years, at 4½ per cent. per annum?

½ ½ 175 : 17 : 0
4
703 : 8 : 0
87 : 18 : 6
7|91 : 6 : 6
20
18|26
12
3|18

½ ½ 7 : 18 : 3
2
15 : 16 : 6
¼ ½ 3 : 19 : 1½
1 : 19 : 6¾
£21 : 15 : 2¼ *Ans.*

29. What is the interest of 397l. 9s. 5d. for 2¼ years, at 3½ per cent. per annum? *Ans.* 31*l.* 6*s.*

30. What is the interest of 576l. 2s. 7d. for 7¼ years, at 4½ per cent. per annum? *Ans.* 187*l.* 19*s.* 1½*d.*

31. What is the interest of 279l. 13s. 8d. at 5½ per cent. per annum, for 3½ years? *Ans.* 51*l.* 7*s.* 10*d.*

When the interest is required for any number of weeks.

RULE. As 52 weeks are to the interest of the given sum for a year, so are the weeks given, to the interest required.

32. What is the interest of 379l. 13s. 2d. for 4 weeks, at 4 per cent. per annum?

```
   w.    l.   s.  d.     w.
As 52 : 15 : 3 : 8½ : : 4
        20
       ---
       303
        12
       ---
      3644
         4
      ----
     14578
         4
  ---------4)
52)58312(1121
   52        ------
   --      12)280¼
   63        ------
   52      2|0)2|3 : 4¼
   --      ------------
   111        1 : 3 : 4¼
   104
   ---
    72
    52
    --
    20
```

```
379 : 13 : 2
           4
------------
15|18 : 12 : 8
   20
   ---
   3|72
     12
   ----
   8|72
      4
   ----
   2|88
```

Or thus; multiply by the number of weeks, and divide the product by 4 *and* 13, *being* 4×13=52

```
13)15 : 3 : 8½
   -----------
    1 : 3 : 4¼
```

☞ *As it is* 4 *weeks, I do not multiply, but only divide by* 13.

33. What is the interest of 259l. 13s. 5d. for 20 weeks, at 5 per cent. per annum? *Ans.* 4*l.* 19*s.* 10½*d.*

34. What is the amount of 375l. 6s. 1d. for 12 weeks, at 4½ per cent. per annum? *Ans.* 379*l.* 4*s.* 0¼*d.*

35. What is the amount of 256l. 5s. 3d. for 25 weeks, at 2¾ per cent. per annum? *Ans.* 259*l.* 13*s.*

When the interest is for any number of days.

Rule. Multiply the pence of the principal by the days and rate per cent. for a dividend, cut off two figures on the right-hand, and divide by 365, the quotient will be the answer in pence. Or, As 365 days, are to the interest of the given sum for a year; so are the days given, to the interest required.

36. What is the interest of 240l. for 120 days, at 4 per cent. per annum?

```
      240
      240
    -----
    57600
      120
  -------
  6912000
        4
  ----------12)
365)276480|00(757
   2555     ------
   ----  2|0)6|3 : 1
   2098     ------
   1825   3 : 3 : 1¼
   ----
   2730
   2555
   ----
    175
      4
   ----
   )700(1
    365
   ----
    335
```

Or thus,

```
240 As 365 : 9.12 : : 120
     4         20
   ----       ----
  9|60         192
    20         120
 ------       -----2|0)
 12|00   365)23040(6|3
              2190     ----------
              ----     £3 : 3 : 1¼
              1140
              1095
              ----
                45
                12
              ----
              )540(1
               365
              ----
               175
                 4
              ----
              )700(1
               365
              ----
               335
```

37. What is the interest of 397l. 5s. 4d. for 3 years and 75 days, at 5 per cent. per annum? *Ans.* 63*l.* 13*s.* 5*d.*

38. At 5½ per cent. per annum, what is the interest of 985l. 2s. 7d. for 5 years 127 days? *Ans.* 289*l.* 15*s.* 3*d.*

39. What is the interest of 2726l. 1s. 4d. at 4½ per cent. per annum, for 3 years 154 days? *Ans.* 419*l.* 15*s.* 6¼*d.*

When the amount, time, and rate per cent. are given, to find the principal.

Rule. As the amount of 100l. at the rate and time given, is to 100, so is the amount given, to the principal required.

40. What principal being put to interest will amount to 402l. 10s. in 5 years, at 3 per cent. per annum?

3×5+100=115l. : 100 : : 402 : 10
20 20
2300 8050
100
23|00)8050|00(£350 *Ans.*

41. What principal being put to interest for 9 years will amount to 734l. 8s. at 4 per cent. per ann. *Ans.* 540*l.*

42. What principal being put to interest for 7 years, at 5 per cent. per ann. will amount to 334l. 16s. *Ans.* 248*l.*

When the principal, rate per cent. and amount are given, to find the time.

Rule. As the interest of the principal for 1 year: is to 1 year : : so is the whole interest to the time required.

43. In what time will 350l. amount to 402l. 10s. at 3 per cent. per annum?

350 As 10 : 10 : 1 : : 52 : 10 : 5
3 20 20
10|50 210 21|0)105|0(5 years. *Ans.* 402 : 10
20 105 350 : 0
10|00 ... 52 : 10

44. In what time will 540l. amount 734l. 8s. at 4 per cent. per annum? *Ans.* 9 *years.*

45. In what time will 248l. amount to 334l. 16s. at 5 per cent. per annum? *Ans.* 7 *years.*

When the principal, amount, and time are given, to find the rate per cent.

Rule. As the principal : is to the interest for the whole time : : so is 100l. : to the interest for the same time. Divide that interest by the time, and the quotient will be the rate per cent.

46. At what rate per cent. will 350l. amount to 402l. 10s. in 5 years time?

350 As 350 : 52 .. 10 : : 100 : 15l.
20
52 : 10 : 0
1050
100
35|0)10500|0(300 £ 15÷5=3 *per cent.*

47. At what rate per cent. will 248l. amount to 334l. 16s. in 7 years time? *Ans.* 5 *per cent.*

48. At what rate per cent. will 540l. amount to 734l. 8s. in 9 years time? *Ans.* 4 *per cent.*

COMPOUND INTEREST

Is that which arises both from the principal and interest: that is, when the interest on money becomes due, and not paid, the same interest is allowed on that interest unpaid, as was on the principal before.

Rule 1. Find the first year's interest, which add to the principal, then find the interest of that sum, which add as before; and so on for a number of years.

2. Subtract the given sum from the last amount, and it will give the compound interest required.

EXAMPLES.

1. What is the compound interest of 500l. forborne 3 years, at 5 per cent. per annum?

500
5
25|00

500
25
525 *1st year.*
5
26|25
20
5|00

525
26 : 5
551 : 5 *2d year.*
5
27|56 : 5
20
11|25
12
3|00

551 : 5
27 : 11 : 3
578 : 16 : 0 *3d year.*
500 *prin. sub.*
78 : 16 : 3 = *interest for 3 years.*

2. What is that amount of 400l. forborne $3\frac{1}{2}$ years, at 6 per cent. per annum, compound interest? *Ans.* 490*l.* 13*s.* $11\frac{1}{4}$*d.*

3. What will 650l. amount to in 5 years, at 5 per cent. per annum, compound interest? *Ans.* 829*l.* 11*s.* $7\frac{1}{2}$*d.*

4. What is the amount of 550l. 10s. for 3 years and 6 months, at 6 per cent per annum, compound interest? *Ans.* 675*l.* 6s. 5*d.*

5. What is the compound interest of 764l. for 4 years and 9 months, at 6 per cent. per annum? *Ans.* 243*l.* 18*s.* 8*d.*

6. What is the compound interest of 57l. 10s. 6d. for 5 years, 7 months, and 15 days, at 5 per cent. per annum? *Ans.* 18*l.* 3*s.* $8\frac{1}{4}$*d.*

7. What is the compound interest of 259l. 10s. for 3 years, 9 months, and 10 days, at $4\frac{1}{2}$ per cent. per annum? *Ans.* 46*l.* 19*s.* $10\frac{1}{2}$*d.*

Rebate or Discount

Is the abating so much money on a debt to be received before it is due, as that money, if put to interest, would gain in the same time, and at the same rate. As 100l. present money would discharge a debt of 105l. to be paid a year to come, rebate being made at 5 per cent.

Rule. As 100l. with the interest for the time given

: is to that interest : : so is the sum given : to the rebate required.

Subtract the rebate from the given sum, and the remainder will be the present worth.

EXAMPLES.

1. What is the discount and present worth of 487l. 12s. for 6 months, at 6 per cent. per annum?

6 m. $\frac{1}{2}$)6

3
100

103

487 : 12
14 : 4

Ans. 473 : 8 *present worth.*

As 103 : 3 : : 487 .. 12
20 20

2060 9752
3
l. *s.*
206|0)2925|6(14 : 4 *rebate.*
206

865
824

416=4*s.*

2. What is the present payment of 357l. 10s. which was agreed to be paid 9 months hence, at 5 per cent. per annum? *Ans.* 344*l.* 11*s.* 7*d.*

3. What is the discount of 275l. 10s. for 7 months, at 5 per cent. per annum? *Ans.* 7*l.* 16*s.* $1\frac{3}{4}$*d.*

4. Bought goods to the value of 109l. 10s. to be paid at 9 months, what present money will discharge the same, if I am allowed 6 per cent. per annum discount? *Ans.* 104*l.* 15*s.* $8\frac{1}{2}$*d.*

5. What is the present worth of 527l. 9s. 1d. payable 7 months hence, at $4\frac{1}{4}$ per cent.? *Ans.* 514*l.* 13*s.* $10\frac{3}{4}$*d.*

6. What is the discount of 85l. 10s. due September the 8th, this being July the 4th, rebate at 5 per cent. per annum? *Ans.* 15*s.* $3\frac{1}{2}$*d.*

7. Sold goods for 875l. 5s. 6d. to be paid 5 months hence, what is the present worth at $4\frac{1}{2}$ per cent.? *Ans.* 859*l.* 3*s.* 4d.

8. What is the present worth of 500l. payable in 10 months, at 5 per cent. per annum? *Ans.* 480*l.*

9. How much ready money can I receive for a note of 75l. due 15 months hence, at 5 per cent? *Ans.* 70*l.* 11*s.* $9\frac{1}{4}$*d.*

10. What will be the present worth of 150l. payable at 3 four months, *i. e.* one-third at 4 months, one-third at 8 months, and one-third at 12 months, at 5 per cent, discount? 145*l.* 3*s.* $9\frac{1}{4}$*d.*

11. Sold goods to the value of 575l. 10s. to be paid at two 3 months, what must be discounted for present payment at 5 per cent.? 10*l.* 11*s.* $4\frac{3}{4}$*d.*

12. What is the present worth of 500l. at 4 per cent. 100l. being to be paid down, and the rest at two 6 months? *Ans.* 488*l.* 7*s.* 9*d.*

Equation of Payments

Is, when several sums are due at different times, to find a mean time for paying the whole debt; to do which, this is the common

Rule. Multiply each term by its time, and divide the sum of the products by the whole debt, the quotient is accounted the mean time.

EXAMPLES.

1. A owes B 200l. whereof 40l. is to be paid at 3 months, 60l. at 5 months, and 100l. at 10 months; at what time may the whole debt be paid together, without prejudice to either?

$$\begin{array}{rcrcr} \text{l.} & & \text{m.} & & \\ 40 & \times & 3 & = & 120 \\ 60 & \times & 5 & = & 300 \\ 100 & \times & 10 & = & 1000 \\ \hline & & & & 2|00)14|20 \\ \hline \end{array}$$

7 months, $\frac{1}{10}$.

2. B owes C 800l. whereof 200l. is to be paid at 3 months, 100l. at 4 months, 300l. at 5 months, and 200l. at 6 months; but they agreeing to make but one payment of the whole, I demand what that time must be?

Ans. 4 *months*, 18 *days*.

3. I bought of K a quantity of goods to the value of 360l. which was to have been paid as follows: 120l. at 2 months, 200l. at 4 months, and the rest at 5 months; but they afterwards agreed to have it paid at one mean time; the time is demanded. *Ans.* 3 *months*, 13 *days*.

4. A merchant bought goods to the value of 500l. to pay 100l. at the end of 3 months, 150l. at the end of 6 months, and 250l. at the end of 12 months; but afterwards they agreed to discharge the debt at one payment; at what time was this payment made?

Ans. 8 *months*, 12 *days*.

5. H is indebted to L a certain sum, which is to be paid at 6 different payments, that is, a $\frac{1}{4}$ at 2 months, $\frac{1}{8}$ at 3 months, $\frac{1}{8}$ at 4 months, $\frac{1}{4}$ at 5 months, $\frac{1}{8}$ at 6 months, and the rest at 7 months; but they agree that the whole shall be paid at one equated time, what is that time?

Ans. 4 *months*, 1 *quarter*.

6. A is indebted to B 120l. whereof $\frac{1}{2}$ is to be paid at 3 months, $\frac{1}{4}$ at 6 months, and the rest at 9 months, what is the equated time of the whole payments?

Ans. 5 *months*, 7 *days*.

Barter

Is the exchanging one commodity for another, and informs the traders so to proportion their goods, that neither may sustain loss.

Rule. 1st. Find the value of that commodity whose quantity is given; then find what quantity of the other, at the rate proposed, you may have for the same money.

2dly. When one has goods at a certain price, *ready money*, but in bartering advances it to something more, find what the other ought to rate his goods at, in proportio to that advance, and then proceed as before.

EXAMPLES.

1. What quantity of chocolate, at 4s. per lb. must be delivered in barter for 2 cwt. of tea, at 9s. per lb.?

```
     2 cwt.
   112
   ───
   224
     9
 ──────
 4)2016 the value of the tea.
 ──────
   504 lb. of chocolate.
```

2. A and B barter; A hath 20 cwt. of prunes, at 4d. per lb. ready money, but in barter will have 5d. per lb. and B hath hops, worth 32s. per cwt. ready money; what ought B to rate his hops at in barter, and what quantity must be given for the 20 cwt. of prunes?

```
          112  As 4 : 5 : : 32
           20               5
  s.      ────            ─────
  40      2240            4)160
  12         5            ─────
 ─────────────cwt. qr. lb.  40s.
48|0)1120|0(23 : 1 : 9 16/48 Ans.
      96
     ────
      160
      144
     ────
       16=1 qr. 9lb. 16/48
```

3. How much tea, at 9s. per lb. can I have in barter for 4 cwt. 2 qrs. of chocolate, at 4s. per lb.? *Ans.* 2 *cwt.*

4. Two merchants barter; A hath 20 cwt. of cheese, at 21s. 6d. per cwt. B hath 8 pieces of Irish cloth, at 3l. 14s. per piece; I desire to know who must receive the difference, and how much?

Ans. B must receive of A 8*l.* 2*s.*

5. A and B barter; A hath $3\frac{1}{2}$ lb. of pepper, at $13\frac{1}{2}$d. per lb. B hath ginger, at $15\frac{1}{4}$d. per lb. how much ginger must he deliver in barter for the pepper? *Ans.* 3*lb.* 1*oz.*$\frac{35}{61}$

6. How many dozen of candles, at 5s. 2d. per dozen, must be delivered in barter for 3 cwt. 2 qrs. 16 lb. of tallow, at 37s. 4d. per cwt. *Ans.* 26 *doz.* 3 *lb.*

7. A hath 608 yards of cloth, worth 14s. per yard, for which B gives him 125l. 12s. in ready money, and 85 cwt. 2 qrs. 24 lb. of bees wax. The question is, what did B reckon his bees wax at per cwt.? *Ans.* 3*l.* 10*s.*

8. A and B barter; A hath 320 dozen of candles, at 4s. 6d. per dozen, for which B giveth him 30l. in money, and the rest in cotton, at 8d. per lb. I desire to know how much cotton B gave A besides the money?

Ans. 11 *cwt.* 1 *qr.*

9. If B hath cotton, at 1s. 2d. per lb. how much must he give A for 114lb. of tobacco, at 6d. per lb.?

Ans. $48\frac{12}{14}$ *lb.*

10. C hath nutmegs worth 7s. 6d. per lb. ready money, but in barter will have 8s. per lb. and D hath leaf-tobacco worth 9d. per lb. ready money, how much must D rate his tobacco at per lb. that his profit may be equivalent with C's?

Ans. $9\frac{1}{2}\,\frac{36}{90}$*d.*

Profit and Loss

Is a rule that discovers what is got or lost in the buying or selling of goods; and instructs us to rise or fall the price, so as to gain or lose so much per cent. or otherwise.

The questions in this rule are performed by the Rule of Three.

EXAMPLES,

1. If a yard of cloth is bought for 11s. and sold for 12s. 6d. what is the gain per cent. ?

```
As  11 :  1 .. 6 : : 100
          12          20
          ——        ————
          18        2000
                      18
12 .. 6             ————
11 .. –         11)36000
———————             ————
 1 .. 6          12)3272
                    ————
              2|0)27|2 .. 8
                 ——————————
```

Ans. £13 .. 12 ..$8\frac{8}{11}$

2. If 60 ells of Holland cost 18l. what must 1 ell be sold for to gain 8 per cent. ?

```
As 100 : 18 : : 108
           108
      ————————       12 × 5 = 60
      1|00)19|44
            20       12)19.. 8..9½
          ————       —————————————
          8|80        5) 1..12..4¾
            12       —————————————
          ————               6..5¾
          9|60
             4
          ————
          2|40
```

Ans. 6*s.* $5\frac{3}{4}$*d.*

3. If 1 lb. of tobacco cost 16d. and is sold for 20d. what is the gain per cent. ? *Ans.* 25*l.*

4. If a parcel of cloth be sold for 560l. and at 12l. per cent. gain, what was the prime cost ? *Ans.* 500*l.*

5. If a yard of cloth is bought for 13s. 4d. and sold again for 16s. what is the gain per cent. ? *Ans.* 20*l.*

6. If 112 lb. of iron cost 27s. 6d. what must 1 cwt. be sold for to gain 15l. per cent. ? *Ans.* 1*l.* 11*s.* $7\frac{1}{2}$*d.*

7. If 375 yards of broad cloth be sold for 490l. and 20l. per cent. profit, what did it cost per yard ? *Ans.* 1*l.* 1*s.* $9\frac{1}{4}$*d.*

8. Sold 1 cwt. of hops for 6l. 15s. at the rate of 25l. per cent. profit, what would have been the gain per cent. if I had sold them for 8l. per cwt. ? *Ans.* 48*l.* 2*s.* $11\frac{1}{2}$*d.*

9. If 90 ells of cambric cost 60l. how must I sell it per yard to gain 18l. per cent. ? *Ans.* 12*s.* 7*d.*

10. A plumber sold 10 fother of lead for 204l. 15s. (the fother being $19\frac{1}{2}$ cwt.) and gained after the rate of 12l. 10s. per cent. what did it cost him per cwt. ?

Ans. 18*s.* 8*d.*

11. Bought 436 yards of cloth, at the rate of 8*s.* 6d.

per yard, and sold it for 10s. 4d. per yard, what was the gain of the whole? *Ans.* 39*l.* 19*s.* 4*d.*

12. Paid 69l. for 1 ton of steel, which is retailed at 6d. per lb. what is the profit or loss by the sale of 14 tons? *Ans.* 182*l. loss.*

13. Bought 124 yards of linen for 32l. how should the same be retailed per yard, to gain 15l. per cent?
Ans. 5*s.* 11$\frac{28}{124}$*d.*

14. Bought 249 yards of cloth, at 3s. 4d. per yard, retailed the same at 4s. 2d. per yard, what is the profit in the whole, and how much per cent.?
Ans. 10*l.* 7*s.* 6*d. profit, and* 25 *per cent.*

Fellowship

Is when two or more join their stocks and trade together, so to determine each person's particular share of the gain or loss, in proportion to his principal in the joint stock.

By this rule a bankrupt's estate may be divided amongst his creditors; as also legacies may be adjusted when there is a deficiency of assets or effects.

FELLOWSHIP IS EITHER WITH OR WITHOUT TIME.

FELLOWSHIP WITHOUT TIME.

Rule. As the whole stock : is to the whole gain or loss : : so is each man's share in stock : to his share of the gain or loss.

Proof. Add all the shares together, and the sum will be equal to the given gain or loss—but the surest way is, as the whole gain or loss : is to the whole stock : : so is each man's share of the gain or loss : to his share in stock.

EXAMPLES.

1. Two merchants trade together; A put into stock 20l. and B 40l. they gained 50l. what is each person's share thereof?

```
                          20+40=60
As 60 : 50 : : 20  As 60 : 50::40    33 :  6 : 8 B's share.
            20                40     16 : 13 : 4 A's.
          ____             ____      _____________
 6|0)100|0              6|200|0      50
 ___________          ___________
 £16 : 13 : 4         £33 : 6 : 8
```

2. Three merchants trade together, A, B, and C; A puts in 20l. B 30l. and C 40l. they gain 180l. what is each man's part of the gain? *Ans. A 40l. B 60l. C 80l.*

3. A, B, and C enter into partnership; A put in 364l. B 482l. and C 500l. and they gained 867l. what is each man's share in proportion to his stock?
Ans. A 234l. 9s. 3¼d. rem. 70. B 310l. 9s. 5d. rem. 248. C 322l. 1s. 3½d. rem. 1028.

4. Four merchants, B, C, D, and E, made a stock: B put in 227l. C 349l. D 115l. and E 439l. in trading they gained 428l. I demand each merchant's share of the gain?
Ans. B 85l. 19s. 6¾d.—690. *C 132l. 3s. 9d.*—120. *D 43l. 11s. 1¾d.*—250. *E 166l. 5s. 6¼d.*—70.

5. Three persons, D, E, and F, join in company; D's stock was 750l. E's 460l. and F's 500l. and at the end of 12 months they gained 684l. what is each man's particular share of the gain? *Ans. D 300l. E 184l. and F 200l.*

6. A merchant is indebted to B 275l. 14s. to C 304l. 7s. to D 152l. and to E 104l. 6s. but upon his decease, his estate is found to be worth but 675l. 15s. how must it be divided among his creditors?
Ans. B's 222l. 15s. 2d.—6584. *C's 245l. 18s. 1½d.*—15750. *D's 122l. 16s. 2¾d.*—12227. *and E's 84l. 5s. 5d.*—15620.

7. Four persons trading together in a joint-stock, of which A has ⅓, B ¼, C ⅕, and D ⅙, and at the end of 6 months they gain 100l.; what is each man's share of the said gain? *Ans. A 35l. 1s. 9d*—48. *B 26l. 6s. 3¾d.*—36. *C 21l. 1s. 0½d.*—120. *and D 17l. 10s. 10½d.*—24.

8. Two persons purchased an estate of 1700l. per annum, freehold, for 27200l. when money was at 6 per cent. interest, and 4s. per pound land-tax, whereof D paid 15000l. and E the rest; some time after the interest of the money falling to 5 per cent. and 2s. per pound land-

tax, they sell the said estate for 24 years purchase; I desire to know each person's share? *Ans. D* 22500*l.* *E* 18300*l.*

9. D, E, and F join their stocks in trade; the amount of their stocks is 647l. and are in proportion as 4, 6, and 8 are to one another, and the amount of this gain is equal to D's stock; what is each man's stock and gain?

D's stock £143 : 15 : $6\frac{12}{43}$ *gain,* £31 : 10 : –. 184036.
E's........215 : 13 : 4 47 : 18 : 6. 414080.
F's........287 : 1 : $1\frac{11}{43}$ 63 : 18 : –. 506098.

10. D, E, and F, join stocks in trade; the amount of their stocks was 100l. D's gain 3l. E's 5l. and F's 8l. What was each man's stock?

Ans. D's stock, 18*l.* 15*s.* *E's* 31*l.* 5*s.* *and F's* 50*l.*

FELLOWSHIP WITH TIME.

Rule. As the sum of the products of each man's money and time: is to the whole gain or loss: : so is each man's product : to his share of the gain or loss.

Proof. As in Fellowship without Time.

EXAMPLES.

1. D and E enter into partnership; D puts in 40l. for 3 months, and E 75l. for 4 months, and they gained 70l. What is each man's share of the gain?

Ans. D 20*l.* *E* 50*l.*

40×3=120	As 420 : 70 : : 120	As 420 : 70 : : 300
75×4=300	120	300
———	———	———
420	42|0)840|0(20	42|0)21000|0(50

2. Three merchants join in company, D puts in stock 195l. 14s. for 3 months, E 169l. 18s. 3d. for 5 months, and F 59l. 14s. 10d. for 11 months, they gained 364l. 18s. What is each man's part of the gain?

Ans. D's 99*l.* 18*s.* $7\frac{1}{4}$*d.* *E's* 153*l.* 2*s.* $3\frac{1}{4}$*d.*
and F's 111*l.* 17*s.* 1*d.*

3. Three merchants join in company for 18 months, D put in 500l. and at 5 months end took out 200l. at 10 months end put in 300l. and at the end of 14 months took out 130l. E puts in 400l. and at the end of 3 months 170l. more; at 9 months he takes out 140l. but puts in 100l. at the end of 12 months, and withdraws 99l. at the end of 15 months. F puts in 900l. and at 6 months took out 200l. at the end of 11 months put in 500l. but takes out that and 100l. more at the end of 13 months. They gained 200l. I desire to know each man's share of the gain?

Ans. D 50l. 7s. 6d.—21720. *E 62l. 12s. 5¼d.*—29859.
and F 87l. 0s. 0¼d.—14167.

4. D, E, and F, hold a piece of ground in common, for which they are to pay 36l. 10s. 6d. D puts in 23 oxen 27 days; E 21 oxen 35 days; and F 16 oxen 23 days. What is each man to pay of the said rent?

Ans. D 13l. 3s. 1½d.—624. *E 15l. 11s. 5d.*—1688.
and F 7l. 15s. 11d.—1136.

Exchange

Is the receiving money in one country for the same value paid in another.

The par of exchange is always fixed and certain, it being the intrinsic value of foreign money, compared with sterling; but the course of exchange rises and falls, upon various occasions.

I. *FRANCE.*

They keep their accounts at Paris, Lyons, and Rouen, in livres, sols, and deniers, and exchange by the crown, =4s. 6d. at par.

NOTE. 12 deniers make 1 sol.
20 sols........ 1 livre.
3 livres ...... 1 crown.

To change French into Sterling.

Rule. As 1 crown : is to the given rate : : so is the French sum : to the sterling required.

To change Sterling into French.

Rule. As the rate of exchange : is to 1 crown : : so is the sterling sum : to the French required.

EXAMPLES.

1. How many crowns must be paid at Paris, to receive in London 180l. exchange, at 4s. 6d. per crown?

d. cr. l.
As 54 : 1 : : 180
240
54)43200(800 *crowns.*
432
...

2. A merchant at Paris remits to his correspondent in London 800 crowns, at 4s. 6d. each; what is the value in sterling?

cr. d. cr.
1 : 54 : : 800
54
12)43200
2|0)360|0
£180

3. How much sterling must be paid in London, to receive in Paris 758 crowns, exchange at 56d. per crown?
Ans. 176*l.* 17*s.* 4*d.*

4. A merchant in London remits 176l. 17s. 4d. to his corespondent at Paris; what is the value of French crowns, at 56d. per crown? *Ans.* 758.

5. Change 725 crowns, 17 sols, 7 deniers, at 54½d. per crown, into sterling, what is the sum? *Ans.* 164*l.* 14*s.* 0½*d.*

6. Change 164l. 14s. 0½d. sterling into French crowns, exchange at 54½d. per crown.
Ans. 725 *crowns*, 17 *sols*, 7 *deniers.*

II. SPAIN.

They keep their accounts at Madrid, Cadiz, and Seville, in dollars, rials, and marvedies, and exchange by the piece of eight=4s. 6d. at par.

Note. 34 marvedies make 1 rial.
8 rials.......... 1 piastre, or piece of eight.
10 rials........... 1 dollar.

Rule. As with France.

EXAMPLES.

7. A merchant at Cadiz remits to London 2547 pieces of eight, at 56d. per piece; how much sterling is the sum? *Ans.* 594*l.* 6*s.*

8. How many pieces of eight, at 56d. each, will answer a bill of 594l. 6s. sterling? *Ans.* 2547.

9. If I pay a bill here of 2500l. what Spanish money may I draw my bill for at Madrid, exchange at 57½ per piece of eight? *Ans.* 10434 *pieces of eight*, 6 *rials*, 8 *mar.*

III. ITALY.

They keep their accounts at Genoa and Leghorn in livres, sols, and deniers, and exchange by the piece of eight, or dollar=4s. 6d. at par.

Note. 12 deniers make 1 sol.
20 sols........1 livre.
5 livres.......1 piece of Eight at Genoa.
6 livres.......1 piece of eight at Leghorn.

☞ The exchange at Florence is by ducatoons; the exchange at Venice by ducats.

Note. 6 solidi make 1 gross.
24 grosses....1 ducat.

Rule. The same as before.

10. How much sterling money may a person receive in London, if he pays in Genoa 976 dollars, at 53d. per dollar? *Ans.* 215*l.* 10*s.* 8*d.*

11. A merchant remitted 215l. 10s. 8d. sterling to Leghorn, how many dollars will he receive there, the exchange being at 53d. per dollar? *Ans.* 976.

12. A factor hath sold goods at Florence, for 250 ducatoons, at 54d. each, what is the value in pounds sterling? *Ans.* 56*l.* 5*s.*

13. A bill of 56l. 5s. is remitted to Florence to be paid in ducatoons, at 54d. each, how many will be received? *Ans.* 250.

14. If 275 ducats, at 4s. 5d. each, be remitted from Venice to London, what is the value in pounds sterling? *Ans.* 60. 14*s.* 7*d.*

15. A gentleman travelling, would exchange 60l. 14s. 7d. sterling for Venice ducats, at 4s. 5d. each, how many must he receive? *Ans.* 275.

IV. PORTUGAL.

They keep their accounts in Oporto and Lisbon, in reas, and exchange on the milrea=6s. $8\frac{1}{2}$d. at par.

Note. 1000 reas make 1 milrea.

Rule. The same as with France.

EXAMPLES.

16. A gentleman being desirous to remit to his correspondent in London 2750 milreas, exchange at 6s. 5*d.* per milrea, how much sterling will he be creditor for in London? *Ans.* 882*l.* 5*s.* 10*d.*

17. If a bill be drawn from London of 882l. 5s. 10d. sterling, how many milreas, at 6s. 5d. each, is equal in value to the said sum? *Ans.* 2750.

18. A merchant at Oporto remits to London 4366 milreas, and 183 reas, at 5s. $5\frac{5}{8}$d. exchange, per milrea, how much sterling must be paid in London for this remittance? *Ans.* 1193*l.* 17*s.* $6\frac{3}{4}$*d.*

19. If I pay a bill at London of 1193l. 17s. $6\frac{3}{4}$d. what must I draw for on my correspondent at Lisbon, exchange at 5s. $5\frac{5}{8}$d. per milrea? *Ans.* 4366 *milreas*, 183 *reas.*

V. HOLLAND, FLANDERS, AND GERMANY.

They keep their accounts at Antwerp, Amsterdam, Brussels, Rotterdam, and Hamburgh; some in pounds, shillings, and pence, as in England; others in guilders, stivers, and pennings; and exchange with us on our pound, at 33s. 4d. Flemish, at par.

Note. 8 pennings make . . . . . . 1 groat.
2 groats, or 16 pennings 1 stiver.
20 stivers . . . . 1 guilder, or florin.

ALSO,

12 groats, or 6 stivers, make 1 schelling.
20 schellings, or 6 guilders. . 1 pound.

To change Flemish into sterling.

Rule. As the given rate : is to 1 pound : : so is the Flemish sum : to the sterling required.

To change sterling into Flemish.

Rule. As 1l. sterling : is to the given rate : : so is the sterling given : to the Flemish sought.

EXAMPLES.

20. Remitted from London to Amsterdam a bill of 754l. 10s. sterling, how many pounds Flemish is the sum, the exchange at 33s. 6d. Flemish per pound sterling? *Ans.* 1263*l.* 15*s.* 9*d. Flemish.*

21. A merchant at Rotterdam remits 1263l. 15s. 9d. Flemish, to be paid in London, how much sterling money must he draw for, the exchange being at 33s. 6d. Flemish per pound sterling? *Ans.* 754*l.* 10*s.*

22. If I pay in London 852l. 12s. 6d. sterling, how many guilders must I draw at Amsterdam, exchange at 34 schellings, 4½ groats Flemish, per pound sterling? *Ans.* 8792 *guilders,* 13 *stivers,* 14½ *pennings.*

23. What must I draw for at London, if I pay at Amsterdam 8792 guilders, 13 stivers, 14½ pennings, exchange at 34 schellings, 4½ groats per pound sterling? *Ans.* 852*l.* 12*s.* 6*d.*

To convert Bank money into current, and the contrary.

Note. The Bank money is worth more than the current. The difference between the one and the other is called Agio, and is generally from 3 to 6 per cent. in favour of the Bank.

To change Bank into current money.

Rule. As 100 guilders Bank : is to 100 with the agio added : : so is the Bank given : to the current required.

To change current money into Bank.

Rule. As 100, with the agio added : is to 100 Bank : : so is the current money given : to the Bank required.

24. Change 794 guilders, 15 stivers, current money, into Bank florins, Agio $4\frac{3}{8}$ per cent.

Ans. 761 *guilders*, 8 *stivers*, 11 *pennings*.

25. Change 761 guilders, 9 stivers, Bank, into current money, Agio $4\frac{3}{8}$ per cent.

Ans. 794 *guilders*, 15 *stivers*, 4 *pennings*.

VI. IRELAND.

26. A gentleman remits to Ireland 575l. 15s. sterling, what will he receive thre, the exchange being at 10 per cent.? *Ans.* 633*l.* 6*s.* 6*d.*

27. What must be paid in London for a remittance of 633l. 6s. 6d. Irish, exchange at 10 per cent.?

Ans. 575*l.* 15*s.*

WALKINGAME'S ARITHMETIC
IMPROVED.

PART II.

Vulgar Fractions.

A fraction is a part or parts of an unit, and written with two figures, with a line between them, as $\frac{1}{4}$, $\frac{5}{6}$, $\frac{3}{8}$, &c.

The figure above the line is called the Numerator, and the under one the denominator; which shews how many parts the unit is divided into; and the numerator shews how many of those parts are meant by the fraction.

There are four sorts of Vulgar Fractions; *proper*, *improper*, *compound*, and *mixed*; viz.

1. A *proper fraction* is when the numerator is less than the denominator, as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{7}{8}$, $\frac{9}{11}$, $\frac{101}{701}$, &c.

2. An *improper fraction* is when the numerator is equal to, or greater than the denominator, as $\frac{5}{3}$, $\frac{8}{4}$, $\frac{12}{12}$, $\frac{197}{2}$, &c.

3. A *compound fraction* is the fraction of a fraction. and known by the word *of*, as $\frac{1}{2}$ *of* $\frac{2}{3}$, *of* $\frac{7}{9}$, *of* $\frac{8}{17}$, *of* $\frac{9}{12}$, &c.

4. A *mixed number* or *fraction* is composed of a whole number and fraction, as $8\frac{2}{7}$, $17\frac{1}{2}$, $8\frac{71}{97}$, &c.

Reduction of Vulgar Fractions.

1. *To reduce fractions to a common denominator.*

Rule 1. Multiply each numerator into all the denominators, except its own, for a new numerator; and all the denominators for a common denominator. Or,

2. Multiply the common denominator by the several given numerators separately, and divide the product by their several denominators, the quotients will be the new numerator.

EXAMPLES.

1. Reduce $\frac{2}{4}$ and $\frac{4}{7}$ to a common denominator.
facit $\frac{14}{28}$, *and* $\frac{16}{28}$.

1st num. 2d num.
2×7=14 4×4=16 *then* 4×7=28 *den.*=$\frac{14}{28}$ *and* $\frac{16}{28}$.

2. Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$ to a common denominator.
facit $\frac{32}{64}$, $\frac{48}{64}$, $\frac{40}{64}$.

3. Reduce $\frac{7}{8}$, $\frac{4}{6}$, $\frac{9}{10}$, and $\frac{6}{7}$ to a common denominator.
facit $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{3024}{3360}$, $\frac{2880}{3360}$.

4. Reduce $\frac{6}{10}$, $\frac{2}{4}$, $\frac{1}{7}$, and $\frac{3}{6}$ to a common denominator.
facit $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, $\frac{840}{1680}$.

5. Reduce $\frac{4}{5}$, $\frac{2}{3}$, $\frac{3}{7}$, and $\frac{1}{8}$ to a common denominator.
facit $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, $\frac{105}{840}$.

6. Reduce $\frac{2}{6}$, $\frac{5}{9}$, $\frac{2}{8}$, and $\frac{3}{5}$ to a common denominator.
facit $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, $\frac{1296}{2160}$.

To reduce a vulgar fraction to its lowest terms.

Rule. Find a common measure by dividing the lower term by the upper, and that divisor by the remainder following, till nothing remain; the last divisor is the common measure; then divide both parts of the fraction by the common measure, and the quotient will give the fraction required.

☞ *If the common measure happen to be 1, the fraction is already in its lowest term; and when a fraction hath ciphers at the right-hand, it may be abbreviated by cutting them off; as,* $\frac{34|0}{141|0}$.

EXAMPLES.

EXAMPLES.

7. Reduce $\frac{24}{32}$ to its lowest terms.

24)32(1
24
—
com. measure 8)24(3 *then* 8)$\frac{24}{32}$(=$\frac{3}{4}$ *facit.*
24
—

8. Reduce $\frac{30}{125}$ to its lowest terms. *facit* $\frac{6}{25}$.
9. Reduce $\frac{208}{684}$ to its lowest terms. *facit* $\frac{52}{171}$.
10. Reduce $\frac{192}{576}$ to its lowest terms. *facit* $\frac{1}{3}$.
11. Reduce $\frac{825}{960}$ to its lowest terms. *facit* $\frac{55}{64}$.
12. Reduce $\frac{5184}{6912}$ to its lowest terms. *facit* $\frac{3}{4}$.

3. *To reduce a mixed number to an improper fraction.*

Rule. Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a numerator, which place over the denominator.

☞ *To express a whole number fraction-ways, set* 1 *for the denominator given.*

EXAMPLES.

13. Reduce $18\frac{3}{7}$ to an improper fraction.

$18\times7+3=129$ *new numerator.* *facit* $\frac{129}{7}$.

14. Reduce $56\frac{13}{22}$ to an improper fraction. *facit* $\frac{1245}{22}$.
15. Reduce $183\frac{5}{21}$ to an improper fraction. *facit* $\frac{3848}{21}$.
16. Reduce $13\frac{4}{5}$ to an improper fraction. *facit* $\frac{69}{3}$.
17. Reduce $27\frac{2}{9}$ to an improper fraction. *facit* $\frac{245}{9}$.
18. Reduce $514\frac{5}{16}$ to an improper fraction. *facit* $\frac{8229}{16}$.

4. *To reduce an improper fraction to its proper terms.*

Rule. Divide the upper term by the lower.

EXAMPLES.

19. Reduce $\frac{129}{7}$ to its proper terms. *facit* $18\frac{3}{7}$.

$129\div7=18\frac{3}{7}$.

20. Reduce $\frac{1245}{22}$ to its proper terms. *facit* $56\frac{13}{22}$.
21. Reduce $\frac{3848}{21}$ to its proper terms. *facit* $183\frac{5}{21}$.
22. Reduce $\frac{69}{5}$ to its proper terms. *facit* $13\frac{4}{5}$.
23. Reduce $\frac{245}{9}$ to its proper terms. *facit* $27\frac{2}{9}$.
24. Reduce $\frac{8229}{16}$ to its proper terms. *facit* $514\frac{5}{16}$.

5. *To reduce a compound fraction to a single one.*

Rule. Multiply all the numerators for a new numerator, and all the denominators for a new denominator.

Reduce the new fraction to its lowest terms, by rule 2.

EXAMPLES.

25. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{8}$ to a single fraction.

facit $\frac{2\times3\times5=30}{3\times5\times8=120}$ *reduced to the lowest term* $=\frac{1}{4}$.

26. Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$ to a single fraction.
facit $\frac{220}{756}=\frac{55}{189}$.

27. Reduce $\frac{11}{12}$ of $\frac{13}{14}$ of $\frac{21}{29}$ to a single fraction.
facit $\frac{3003}{\text{[illegible]}72}=\frac{143}{232}$.

28. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a single fraction.
facit $\frac{135}{240}=\frac{9}{16}$.

29. Reduce $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$ to a single fraction.
facit $\frac{168}{360}=\frac{7}{15}$.

30. Reduce $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{8}{10}$ to a single fraction.
facit $\frac{80}{630}=\frac{8}{63}$.

6. *To reduce fractions of one denomination to the fraction of another*, but greater, *retaining the same value.*

Rule. Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that denomination which you would reduce it to; then reduce that compound fraction to a single one.

EXAMPLES.

31. Reduce $\frac{7}{8}$ of a penny to the fraction of a pound.
facit $\frac{7}{8}$ *of* $\frac{1}{12}$ *of* $\frac{1}{20}=\frac{7}{1920}$.

32. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound. *facit* $\frac{1}{960}$.

33. Reduce $\frac{4}{5}$ of a dwt to the fraction of a lb. troy. *facit* $\frac{4}{1200}$.

34. Reduce $\frac{4}{7}$ of a lb. avoirdupoise to the fraction of an cwt. *facit* $\frac{4}{784}$.

7. *To reduce fractions of one denomination to the fraction of another*, but less, *retaining the same value.*

Rule. Multiply the numerator by the parts contained in the several denominations between it, and that you would reduce it to, for a new numerator, and place it over the given denominator.

Reduce the new fraction to its lowest terms.

EXAMPLES.

35. Reduce $\frac{7}{1920}$ of a pound to the fraction of a penny. *facit* $\frac{7}{8}$.

$7 \times 20 \times 12 = 1680 \frac{1680}{1920}$ *reduced to its lowest term* $= \frac{7}{8}$.

36. Reduce $\frac{1}{960}$ of a pound to the fraction of a penny. *facit* $\frac{1}{4}$.

37. Reduce $\frac{4}{1200}$ of a lb. troy to the fraction of a pennyweight. *facit* $\frac{4}{5}$.

38. Reduce $\frac{4}{784}$ of an cwt. to the fraction of a lb. *facit* $\frac{4}{7}$.

8. *To reduce fractions of one denomination to another of the same value, having the numerator given of the required fraction.*

Rule. As the numerator of the given fraction : is to its denominator : : so is the numerator of the intended fraction : to its denominator.

EXAMPLES.

39. Reduce $\frac{2}{3}$ to a fraction of the same value, whose numerator shall be 12. *As* 2 : 3 : : 12 : 18. *facit* $\frac{12}{18}$.

40. Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 25. *facit* $\frac{25}{35}$.

41. Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 47. *facit* $\frac{47}{65\frac{4}{5}}$.

9. *To reduce fractions of one denomination to another of the same value, having the denominator given of the fraction required.*

Rule. As the denominator of the given fraction : is to its numerator : : so is the denominator of the intended fraction : to its numerator.

EXAMPLES.

42. Reduce $\frac{2}{3}$ to a fraction of the same value, whose denominator shall be 18. *As* 3 : 2 : : 18 : 12. *facit* $\frac{12}{18}$.

43. Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be 35. *facit* $\frac{25}{35}$.

44. Reduce $\frac{5}{7}$ to a fraction of the same value whose denominator shall be $65\frac{4}{5}$. *facit* $\frac{47}{65\frac{4}{5}}$.

10. *To reduce a mixed fraction to a single one.*

Rule. When the numerator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new numerator; then multiply the denominator of the fraction by the denominator of the fractional part for a new denomintor.

EXAMPLES.

45. Reduce $\frac{36\frac{2}{3}}{48}$ to a simple fraction. *facit* $\frac{110}{144}=\frac{55}{72}$.

$36\times3+2=110$ *numerator.*
$48\times3\quad=144$ *denominator.*

46. Reduce $\frac{23\frac{5}{7}}{38}$ to a simple fraction. *facit* $\frac{166}{266}=\frac{85}{133}$.

When the denominator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new denominator; then multiply the numerator of the fraction by the denominator of the fractional part for a new numerator.

EXAMPLES.

47. Reduce $\frac{47}{65\frac{4}{5}}$ to a simple franction. *facit* $\frac{235}{329}=\frac{5}{7}$.

48. Reduce $\frac{19}{44\frac{1}{3}}$ to a simple fraction. *facit* $\frac{57}{133}=\frac{3}{7}$.

11. *To find the proper quantity of a fraction in the known parts of an integer.*

Rule. Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

49. Reduce $\frac{3}{4}$ of a pound sterling to its proper quantity. $3\times20=60\div4=15$s. *facit* 15*s.*

50. Reduce $\frac{2}{5}$ of a shilling to its proper quantity. *facit* 4*d.* 3 *qrs.* $\frac{1}{5}$,

51. Reduce $\frac{4}{7}$ of a lb. avoirdupoise to its proper quantity. *facit* 9 *oz.* 2 *dr.* $\frac{2}{7}$.

52. Reduce $\frac{7}{9}$ of an cwt. to its proper quantity. *facit* 3 *qrs.* 3 *lb.* 1 *oz.* 12 *drs.* $\frac{4}{9}$.

53. Reduce $\frac{3}{5}$ of a lb. troy to its proper quantity. *facit* 7 *oz.* 4 *dwt.*

54. Reduce $\frac{5}{9}$ of an ell English to its proper quantity. *facit* 2 *qrs.* 3 *nails* $\frac{1}{9}$.

55. Reduce $\frac{4}{5}$ of a mile to its proper quantity. *facit* 6 *furl.* 16 *poles.*

56. Reduce $\frac{5}{8}$ of an acre to its proper quantity. *facit* 2 *roods,* 20 *poles.*

57. Reduce $\frac{6}{7}$ of an hogshead of wine to its proper quantity. *facit* 54 *gallons.*

58. Reduce $\frac{3}{9}$ of a barrel of beer to its proper quantity. *facit* 12 *gallons.*

59. Reduce $\frac{5}{12}$ of a chaldron of coals to its proper quantity. *facit* 15 *bushels.*

60. Reduce $\frac{3}{5}$ of a month to its proper time. *facit* 2 *weeks,* 2 *days,* 19 *hours,* $\frac{1}{5}$.

12. *To reduce any given quantity to the fraction of any greater denomination, retaining the same value.*

Rule. Reduce the given quantity to the lowest term mentioned for a numerator, under which set the integral part (reduced to the same term) for a denominator, and it will give the fraction required.

EXAMPLES.

61. Reduce 15s. to the fraction of a pound sterling. *facit* $\frac{15}{20}=\frac{3}{4}$£.

62. Reduce 4d. 3 qrs. $\frac{1}{5}$ to the fraction of a shilling. *facit* $\frac{2}{5}$.

63. Reduce 9 oz. 2 dr. $\frac{2}{7}$ to the fraction of a lb. avoirdupoise. *facit* $\frac{4}{7}$.

64. Reduce 3 qrs. 3 lb. 1 oz. 12 dr. $\frac{4}{9}$ to the fraction of an cwt *facit* $\frac{7}{9}$.

65. Reduce 7 oz. 4 dwt. to the fraction of a lb. troy. *facit* $\frac{3}{5}$.

66. Reduce 2 qrs. 3 nails, $\frac{1}{9}$, to the fraction of an English ell. *facit* $\frac{5}{9}$.

67. Reduce 6 furlongs 16 poles to the fraction of a mile. *facit* $\frac{4}{5}$.

68. Reduce 2 roods 20 poles to the fraction of an acre. *facit* $\frac{5}{8}$.

69. Reduce 54 gallons to the fraction of a hogshead of wine. *facit* $\frac{6}{7}$.

70. Reduce 12 gallons to the fraction of a barrel of beer. *facit* $\frac{1}{3}$.

71. Reduce 15 bushels to the fraction of a chaldron of coals. *facit* $\frac{5}{12}$.

72. Reduce 2 weeks, 2 days, 19 hours, $\frac{1}{5}$, to the fraction of a month. *facit* $\frac{3}{5}$.

Addition of Vulgar Fractions.

RULE.

Reduce the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

EXAMPLES.

1. Add $\frac{2}{3}$ and $\frac{5}{7}$ together. *facit* $\frac{14}{21}+\frac{15}{21}=\frac{29}{21}=1\frac{8}{21}$.
2. Add $\frac{3}{4}$, $\frac{2}{7}$, and $\frac{5}{6}$ together. *facit* $1\frac{146}{168}$.
3. Add $\frac{1}{5}$, $4\frac{1}{3}$, and $\frac{2}{5}$ together. *facit* $4\frac{70}{75}$.
4. Add $7\frac{2}{3}$ and $\frac{2}{5}$ together. *facit* $8\frac{1}{15}$.
5. Add $\frac{2}{7}$ and $\frac{2}{3}$ of $\frac{3}{4}$ together. *facit* $\frac{11}{14}$.
6. Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. *facit* $17\frac{1}{24}$.

2. When the fractions are of several denominations, reduce them to their proper quantities, and add as before.

7. Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a shilling. *facit* 15*s*. 10*d*.
8. Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. *facit* 13*s*. $4\frac{1}{2}$*d*.
9. Add $\frac{3}{4}$ of a pound troy to $\frac{1}{6}$ of an ounce.
facit 9 *oz*. 3 *dwt*. 8 *gr*.
10. Add $\frac{4}{5}$ of a ton to $\frac{6}{9}$ of a lb.
facit 16 *cwt*. 10 *oz*. 5 *dr*. $\frac{1}{3}$.
11. Add $\frac{2}{3}$ of a chaldron to $\frac{1}{4}$ of a bushel.
facit 24 *bush*. 3 *peck*.
12. Add $\frac{1}{6}$ of a yard to $\frac{2}{3}$ of an inch.
facit 6 *inch*. 2 *bar*. *c*.

Subtraction of Vulgar Fractions.

RULE.

Reduce the given fractions to a common denominator, then subtract the less numerator from the greater, and place the remainder over the common denominator.

2. When the lower fraction is greater than the upper,

subtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{5}{7}$ $3\times7=21$. $5\times4=20$. $21-20=1$ *num.* $4\times7=28$ *den.* *facit* $\frac{1}{28}$.
2. From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{8}$. *facit* $\frac{11}{24}$.
3. From $5\frac{2}{3}$ take $\frac{9}{10}$. *facit* $4\frac{23}{30}$.
4. From $\frac{38}{47}$ take $\frac{3}{5}$. *facit* $\frac{49}{235}$.
5. From $\frac{19}{20}$ take $\frac{1}{7}$ of $\frac{2}{3}$. *facit* $\frac{359}{420}$.
6. From $64\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$. *facit* $63\frac{3}{4}$.

3. When the fractions are of several denominations, reduce them to their proper quantities, and subtract as before.

7. From $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a shilling. *facit* 14*s.* 3*d.*
8. From $\frac{2}{3}$ of a shilling take $\frac{1}{2}$ of a penny. *facit* $7\frac{1}{2}$*d.*
9. From $\frac{3}{4}$ of lb. troy take $\frac{1}{6}$ of an ounce. *facit* 8 *oz.* 16 *dwts.* 16 *gr.*
10. From $\frac{4}{5}$ of a ton take $\frac{5}{6}$ of a lb. *facit* 15 *cwt.* 3 *qrs.* 27 *lb.* 2 *oz.* 10 *dr.* $\frac{2}{3}$.
11. From $\frac{2}{3}$ of a chaldron take $\frac{3}{4}$ of a bushel. *facit* 25 *bush.* 1 *pk.*
12. From $\frac{1}{6}$ of a yard take $\frac{2}{3}$ of an inch. *facit* 5 *in.* 1 *b.c.*

Multipliation of vulgar Fractions.

RULE.

Prepare the given numbers (if they require it) by the rules of reduction; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

☞ *When any number, either whole or mixed, is multiplied by a fraction, the product will be always less than the multiplicand, in the same proportion as the multiplying fraction is less than an unit.*

EXAMPLES.

EXAMPLES.

1. Multiply $\frac{3}{4}$ by $\frac{3}{5}$.
facit $3 \times 3 = 9$ *num.* $4 \times 5 = 20$ *den.* $= \frac{9}{20}$.
2. Multiply $\frac{7}{9}$ by $\frac{2}{3}$. *facit* $\frac{14}{27}$.
3. Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$. $672\frac{9}{30}$.
4. Multiply $430\frac{6}{10}$ by $18\frac{3}{7}$. *facit* $7935\frac{24}{70}$.
5. Multiply $\frac{16}{21}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$. *facit* $\frac{96}{294} = \frac{16}{49}$.
6. Multiply $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. *facit* $\frac{3}{8}$.
7. Multiply $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{3}$. *facit* $\frac{1}{9}$.
8. Multiply $\frac{1}{4}$ of $\frac{3}{8}$ by $\frac{5}{7}$. *facit* $\frac{15}{224}$.
9. Multiply $5\frac{6}{7}$ by $\frac{5}{6}$. *facit* $4\frac{37}{42}$.
10. Multiply 24 by $\frac{2}{3}$. *facit* 16.
11. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$. *facit* $5\frac{29}{32}$.
12. Multiply $9\frac{1}{2}$ by $\frac{2}{6}$. *facit* $3\frac{1}{6}$.

Division of Vulgar Fractions.

RULE.

Prepare the given numbers (if they require it) by the ules of reduction, then multiply the denominator of he divisor into the numerator of the dividend for a new numerator, and the numerator of the divisor into he denominator of the dividend for a new denominator.

☞ *When any whole number is divided by a fraction less han unity, the quotient will be greater than the dividend; ut if any fraction be divided by a whole number greater than unity, the quotient will be less than the dividend.*

EXAMPLES.

1. Divide $\frac{9}{20}$ by $\frac{3}{5}$.
facit $5 \times 9 = 45$ *num.* $3 \times 20 = 60$ *den.* $\frac{45}{60} = \frac{3}{4}$.
2. Divide $\frac{14}{27}$ by $\frac{2}{3}$. *facit* $\frac{7}{9}$.
3. Divide $672\frac{9}{30}$ by $13\frac{5}{6}$. *facit* $48\frac{3}{5}$.
4. Divide $7935\frac{24}{70}$ by $18\frac{3}{7}$. *facit* $430\frac{3}{5}$.
5. Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. *facit* $\frac{9}{10}$.
6. Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{3}{4}$. *facit* $19\frac{41}{45}$.

7. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$. *facit* $\frac{24}{36}=\frac{2}{3}$.
8. Divide $9\frac{2}{12}$ by $\frac{1}{2}$ of 7. *facit* $2\frac{13}{21}$.
9. Divide $\frac{9}{16}$ by $4\frac{1}{2}$. *facit* $\frac{1}{8}$.
10. Divide 16 by 24. *facit* $\frac{2}{3}$.
11. Divide $5205\frac{2}{10}$ by $\frac{4}{5}$ of 91. *facit* $71\frac{1}{2}$.
12. Divide $3\frac{1}{6}$ by $9\frac{1}{2}$. *facit* $\frac{1}{3}$.

The Single Rule of Three Direct in Vulgar Fractions.

RULE.

Reduce the numbers as before directed in Reduction, so that the first and third may be of the same name: multiply the numerator of the first fraction by the denominator of the second and third, for a new denominator; then multiply the denominator of the first fraction by the numerator of the second and third, for a new numerator; that fraction will be the answer to the question, which reduce to its proper quantity.—Or, when the 3 terms are properly reduced, proceed as in the rule of three of whole numbers.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard cost $\frac{5}{8}$ of a l. what will $\frac{9}{10}$ of a yard come to at that rate? *Ans.* $\frac{18}{24}=15s.$

$$\tfrac{3}{4}\,yd. : \tfrac{5}{8}\,\pounds. :: \tfrac{9}{10}\,yd. : \tfrac{18}{24}\,\pounds.$$

$$\begin{array}{ll} for & 4\times5\times\ \ 9=180\ num. \\ and & 3\times8\times10=240\ den. \end{array} \quad or\ \tfrac{5}{8}\times\tfrac{9}{10}=\tfrac{45}{80}\ \ \tfrac{3}{4})\tfrac{45}{80}(\tfrac{15}{20}.$$

2. If $\frac{5}{6}$ of a yard cost $\frac{2}{3}$ l. what will $\frac{11}{12}$ of a yard cost? *Ans.* 14*s.* 8*d.*

3. If $\frac{3}{4}$ of a yard of lawn cost 7s. 3d. what will $10\frac{1}{3}$ yards cost? *Ans.* 4*l.* 19*s.* $10\frac{1}{2}$*d.* $\frac{2}{3}$.

4. If $\frac{7}{8}$ lb. cost $\frac{3}{4}$ s. how many pound will $\frac{8}{9}$ of 1s. buy? *Ans.* 1 *lb.* $\frac{8}{216}$.

5. If $\frac{3}{5}$ ell of Holland cost $\frac{1}{3}$ l. what will 12 ells $\frac{2}{3}$ cost at that rate? *Ans.* 7*l.* $8\frac{3}{4}$*d.* $\frac{15}{27}$.

6. If $12\frac{1}{2}$ yards cloth cost 15s. 9d. what will $48\frac{1}{4}$ cost at the same rate? *Ans.* 3*l.* $9\frac{1}{2}$*d.* $\frac{16}{100}$.

7. If $\frac{9}{10}$ of an cwt. cost 284s. what will 7 cwt. $\frac{1}{2}$ cost at the same rate? *Ans.* 118*l.* 6*s.* 8*d.*

8. If 3 yards of broad cloth cost 2l. $\frac{4}{5}$, what will 10 yards $\frac{2}{7}$ cost? *Ans.* 9*l.* 12*s.*

9. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a l. what will $\frac{3}{5}$ of an ell English come to at the same rate? *Ans.* 2*l.*

10. If 1 lb. of cochineal cost 1l. 5s. what will 36 lb. $\frac{7}{10}$ come to? *Ans.* 45*l.* 17*s.* 6*d.*

11. If 1 yard of broad cloth cost 15s. $\frac{5}{8}$, what will 4 pieces cost, each containing 27 yards $\frac{3}{7}$? *Ans.* 85*l.* 14*s.* 3*d.* $\frac{140}{450}$.

12. Bought 3 pieces $\frac{1}{2}$ of silk, each containing 24 ells $\frac{3}{8}$, at 6s. 0$\frac{3}{4}$d. per ell, I desire to know what the whole quantity cost? *Ans.* 25*l.* 17*s.* 2$\frac{1}{2}$*d.* $\frac{15}{16}$.

The Single Rule of Three Inverse in Vulgar Fractions.

EXAMPLES.

If 48 men can build a wall in 24 days $\frac{1}{4}$, how many men can do the same in 192 days? *Ans.* 6 *men* $\frac{48}{768}$.

2. If 25s. $\frac{2}{7}$ will pay for the carriage of an cwt. 145 miles $\frac{1}{4}$, how far may 6 cwt. $\frac{1}{2}$ be carried for the same money? *Ans.* 22 *miles* $\frac{9}{26}$.

3. If 3 $\frac{1}{4}$ yards of cloth, that is 1 $\frac{2}{5}$ yard wide be sufficient to make a cloak, how much must I have of that sort which is $\frac{4}{5}$ yard wide, to make another of the same bigness? *Ans.* 4 $\frac{7}{8}$ *yards.*

4. If 3 men can do a piece of work in 4 hours $\frac{1}{2}$, in how many hours will 10 men do the same work? *Ans.* 1 *hour* $\frac{7}{20}$.

5. If a penny white loaf weigh 7 oz. when a bushel of wheat cost 5s. 6d. what is the bushel worth when the penny white loaf weighs but 2 oz. $\frac{1}{2}$? *Ans.* 15*s.* 4*d.* $\frac{4}{5}$.

6. What quantity of shalloon that is $\frac{3}{4}$ yard wide will line 7$\frac{1}{2}$ yards of cloth that is 1$\frac{1}{2}$ yard wide? *Ans.* 15 *yards.*

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WALKINGAME'S ARITHMETIC IMPROVED.

PART III.

Decimal Fractions.

In decimal fractions the integer or whole thing, as one pound, one yard, one gallon, &c. is supposed to be divided into ten equal parts, and those parts into tenths, and so on without end.

So that the denominator of a decimal, being always known to consist of an unit with as many ciphers as the numerator has places, is therefore never set down; the parts being only distinguished from the whole numbers by a comma prefixed; thus, ,5 which stands for $\frac{5}{10}$, ,25 for $\frac{25}{100}$, ,123 for $\frac{123}{1000}$.

But the different value of figures appear plainer by the following table.

Whole numbers.							Decimal parts.					
7	6	5	4	3	2	1	2	3	4	5	6	7
Millions.	C thousands.	X thousands.	Thousands.	Hundreds.	Tens.	Units.	Parts of tens.	Parts of hundreds.	Parts of thousands.	Parts of X thousands.	Parts of C thousands.	Parts of millions.

From which it plainly appears, that, as whole numbers increase in a ten-fold proportion to the left-hand, decimal parts decrease in a ten-fold proportion to the right-hand: so that ciphers placed before decimal parts decrease their value, by removing them farther from the comma, or units place; thus, ,5 is 5 parts of 10, or $\frac{5}{10}$; ,05 is 5 parts of 100, or $\frac{5}{100}$; ,005 is 5 parts of 1000, or $\frac{5}{1000}$; ,0005 is 5 parts of 10000, or $\frac{5}{10000}$. But ciphers after decimal parts do not alter their value. For ,5, ,50, ,500, &c. are each but $\frac{5}{10}$ of the unit.

A *finite decimal* is that which ends at a certain number of places; but an *infinite* is that which no where ends.

A *recurring decimal* is that wherein one or more figures are continually repeated, as 2,75222.

And 52,275275275 is called a *compound recurring decimal.*

Note. *A finite decimal may be considered as infinite, by making ciphers to recur; for they do not alter the value of the decimal.*

In all operations, if the result consists of several nines, reject them, and make the next superior place an unit more; thus for 26,25999 write 26,26.

In all circulating numbers, dash the figure; thus, in 6,54,66.

Addition of Decimals.

RULE.

In setting down the proposed numbers to be added, great care must be taken in placing every figure directly underneath those of the same value, whether they be mixed numbers, or pure decimal parts; and to perform which there must be a due regard had to the commas, or separating points, which ought always to stand in a direct line, one under another, and to the right-hand of them carefully place the decimal parts, according to their respective values: then add them as in whole numbers.

EXAMPLES.

1. Add 72,5+32,071+2,1574+371,4+2,75.

Facit 480,8784.

2. Add 30,07+2,00,71+59,4+3207,1.
3. Add 3,5+47,25+927,01+2,0073+1,5.
4. Add 52,75+47,21+724+31,452+,3075.
5. Add 3275+27,514+1,005+725+7,32.
6. Add 27,5+52+3,2075+,5741+2720.

Subtraction of Decimals.

RULE.

Subtraction of decimals differs but little from whole numbers, only in placing the numbers, which must be carefully observed, as in addition.

EXAMPLES.

1. From ,2754 take ,2371
2. From 2,37 take 1,76
3. From 271 take 215,7
4. From 270,2 take 75,4075
5. From 571 take 54,72
6. From 625 take 76,91
7. From 23,415 take ,3742
8. From ,107 take ,0007

Multiplication of Decimals.

RULE.

Place the factors, and multiply them as in whole numbers, and from the product towards the right-hand cut off as many places for decimals as there are in both factors together; but if there should not be so many places in the product, supply the defect with ciphers to the left-hand.

EXAMPLES.

1. Muliply ,2365 by ,2435. *Facit* ,05758775.
2. Multiply 2,071 by 2,27
3. Multiply 27,15 by 25,3
4. Multiply 79347 by 23,15
5. Multiply 17105 by ,3257
6. Multiply 17105 by ,0237
7. Multiply 27,35 by 7,70071
8. Multiply 5,721 by ,0075
9. Multiply 2,07 by ,007
10. Multiply 20,15 by ,2705
11. Multiply ,907 by ,0025

When any number of decimals is to be multiplied by 10, 100, 1000, &c. it is only removing the separating point in the multiplicand so many places towards the right-hand as there are ciphers in the multiplier: thus, 578× 10=5,78. ,578×100=57,8. ,578×1000=578. 578× 10000=5780.

Division of Decimals.

This rule is also worked as in whole numbers: the only difficulty is in valuing the quotient, which is done by any of the following rules.

RULE 1. The first figure in the quotient is always of the same value with that figure of the dividend, which answers or stands over the place of units in the divisor.

2. The quotient must have always so many decimal places, as the dividend has more than the divisor.

NOTE 1. *If the divisor and dividend have both the same number of decimal parts, the quotient will be a whole number.*

2. *If the dividend has not so many places of decimals as are in the divisor, then so many ciphers must be annexed to the dividend as will make them equal, and the quotient will then be a whole number.*

3. *But if, when the division is done, the quotient has not so many figures as it should have places of decimals, then so many ciphers must be prefixed as there are places wanting.*

EXAMPLES.

1. Divide 8564,825 by 6,321. *Facit* 1354,9.
2. Divide 48 by 144
3. Divide 217,75 by 65
4. Divide 125 by ,1045
5. Divide 709 by 2,574
6. Divide 5,714 by 8275
7. Divide 7382,54 by 6,4252
8. Divide ,0851648 by 423
9. Divide 267,15975 by 13,25
10. Divide 72,1564 by ,1347
11. Divide 715 by ,3075

When numbers are to be divided by 10, 100, 1000, 10,000, &c. it is performed by placing the separating point in the dividend, so many places towards the left-hand, as there are ciphers in the divisor.

Thus, 5784÷10=578,4
5784÷100=57,84
5784÷1000=5,784
5784÷10000=,5784

Reduction of Decimals.

To reduce a vulgar fraction to a decimal.

RULE.

Add ciphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

EXAMPLES.

1. Reduce $\frac{1}{4}$...... to a decimal. 4)1,00(,25 *Facit.*
2. Reduce $\frac{1}{2}$...... to a decimal. *Facit* ,5.
3. Reduce $\frac{3}{4}$...... to a decimal. *Facit* ,75.
4. Reduce $\frac{3}{8}$...... to a decimal. *Facit* ,375.
5. Reduce $\frac{5}{26}$..... to a decimal. *Facit* ,1923076+.
6. Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a decimal. *Facit* ,6043956+.

Note, If the given parts are of several denominations, they may be reduced either by so many distinct operations, as there are different parts, or by first reducing them into their lowest denomination, and then divide as before; or,

2*dly*, Bring the lowest into decimals of the next superior denomination, and on the left-hand of the decimal found, place the parts given of the next superior denomination; so proceeding till you bring out the decimal parts of the highest integer required, by still dividing the product by the next superior denominator; or,

3*dly*, To reduce shillings, pence, and farthings. If the number of shillings be even, take half for the first place of decimals, and let the second and third places be filled up with the farthings contained in the remaining pence and farthings, always remembering to add 1, when it is or exceeds 25. But if the number of shillings be odd, the second place of decimals must be increased by 5. Next divide half the number of farthings in the pence and farthings (rejecting 24 or 6d. if there be 6d.) by 12; the quotient, written after the three places before found, will give the decimal required.

7. Reduce 5s. to the decimal of a l. *Facit* ,25.
8. Reduce 9s. to the decimal of a l. *Facit* ,45.

9. Reduce 16s. to the decimal of a l. *Facit* ,8.

10. Reduce 8s. 4d. to the decimal of a l. *Facit* ,416.

11. Reduce 16s. 7¾d. to the decimal of a l.
Facit ,8322916.

first	second	third	
16s. 7¾d.	4)3,00	2)16	7¾
12	———	———	4
———	12)7,75	,832	—
199	———		32
4	2|0)16,64583		
———	———		
960)799(,8322916	,8322916		

12. Reduce 19s. 5½d. to the decimal of a l.
Facit ,972916.

13. Reduce 12 grains to the decimal of a lb. troy.
Facit ,002083.

14. Reduce 12 drams to the decimal of a lb. avoirdupoise. *Facit* ,046875.

15. Reduce 2 qrs. 14 lb. to the decimal of an cwt.
Facit ,625.

16. Reduce 2 furlongs to the decimal of a league.
Facit ,0833.

17. Reduce 2 quarts, 1 pint, to the decimal of a gallon.
Facit ,625.

18. Reduce 4 gallons, 2 quarts of wine, to the decimal of an hogshead. *Facit* ,071428+.

19. Reduce 2 gallons, 1 quart of beer, to the decimal of a barrel. *Facit* ,0625.

20. To reduce 52 days to the decimal of a year.
Facit ,142465+.

To find the value of the decimal of a pound sterling by inspection.

RULE. Double the first figures or *primes* for shillings, and if the second be 5, or exceed 5, reckon one shilling more: The figures in the second and third places (rejecting 5 from the second) are so many farthings, abating 1 for every 25.

,8322916 of a l.

———

16s. 7¾d.

To

To find the value of any decimal fraction, *in the known parts of an* integer.

Rule. Multiply the decimal given, by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding, till you have brought in the least known parts of the integer.

EXAMPLES.

21. What is the value of ,8322916 of a l. *Ans.* 16*s.* 7$\frac{1}{2}$.+

```
  ,8322916
        20
----------
16,6458320
        12
----------
 7,7499840
         4
----------
 ½,9999360
```

22. What is the value of ,002084 of a lb. troy? *Ans.* 12,00384 *qrs.*

23. What is the value of ,046875 of a lb. avoirdupoise? *Ans.* 12 *drams.*

24. What is the value of ,625 of a cwt.? *Ans.* 2 *qrs.* 14 *lb.*

25. What is the value of ,625 of a gallon? *Ans.* 2 *quarts*, 1 *pint.*

26. What is the value of ,071428 of a hogshead of wine? *Ans.* 4 *gallons*, 1 *quart*, ,999856.

27. What is the value of ,0625 of a barrel of beer? *Ans.* 2 *gallons*, 1 *quart.*

28. What is the value of ,142465 of a year? *Ans.* 51,999725 *days.*

Decimal

Decimal TABLES of COIN, WEIGHT, and MEASURE.

TABLE I.
ENGLISH COIN.
1l. the Integer.

Sh.	*dec.*	*Sh.*	*dec.*
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	,3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5		

Pence.	*Decimals.*
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Farth.	*Decimals.*
3	,003125
2	,0020833
1	,0010416

TABLE II.
ENG. COIN. 1 *Sh.* Long Meas. 1 *Ft.* the Integer.

Pence and Inches.	*Decimals.*
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

Farths.	*Decimals.*
3	,0625
2	,041666
1	,020833

TABLE III.
TROY WEIGHT
1 lb. the Integer.

Ounces the same as Pence in the last Table.

Penny-weight.	*Decimals.*
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Grains.	*Decimals.*
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 Oz. the Integer.

Penny-weights the same as Shillings in the first Table.

Grains.	*Decimals.*
12	,025
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.
AVOIRDUP. WT.
112lb. the Integer.

Qrs.	*Decimals.*
3	,75
2	,5
1	,25

Pounds.	*Decimals.*
14	,125
13	,116071
12	,107143
11	,098214
10	,089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

Ounces.	*Decimals.*
8	,004464
7	,003906

6	,003348
5	,002790
4	,002232
3	,001674
2	,001116
1	,000558

¼ Oz.	Decimals.
3	,000418
2	,000279
1	,000139

TABLE V.

AVOIRDUP. WT.
1 lb. the Integer.

Ounces.	Decimals.
8	,5
7	,4375
6	,375
5	,3125
4	,25
3	,1875
2	,125
1	,0625

Drams.	Decimals.
8	,03125
7	,027343
6	,023437
5	,019531
4	,015625
3	,011718
2	,007812
1	,003906

TABLE VI.

LIQUID MEAS.
1 Tun the Integer.

Gallons.	Decimals.
100	,396825
90	,357141
80	,317460
70	,27777
60	,238095
50	,198412
40	,158730
30	,119047
20	,079365
10	,039682
9	,035714
8	,031746
7	,027777
6	,023809
5	,019841
4	,015873
3	,011904
2	,007936
1	,003968

Pints.	Decimals.
4	,001984
3	,001488
2	,000992
1	,000496

A Hogshead the Integer.

Gallons.	Decimals.
30	,476190
20	,317460
10	,158730
9	,142857
8	,126985
7	,111111
6	,095238
5	,079365
4	,063492
3	,047619
2	,031746
1	,015873

Pints.	Decimals.
3	,005952
2	,003968
1	,001984

TABLE VII.

MEASURE.
Liquid. Dry.
1 Gallon. 1 Quarter
Integer.

Pints.	Dec.	Bush.
4	,5	4
3	,375	3
2	,25	2
1	,125	1

Q.pt.	Decim.	Peck.
3	,09375	3
2	,0625	2
1	,03125	1

Decimals.	Q. pecks.
,0234373	3
,015625	2
,0078125	1

Decimals.	Pints.
,005859	3
,003906	2
,001953	1

TABLE VIII.

LONG MEASURE.
1 Mile the Integer.

Yards.	Decimals.
1000	,568182
900	,511364
800	,454545
700	,397727
600	,34[illegible]

500	,284091
400	,227272
300	,170454
200	,113636
100	,056818
90	,051136
80	,045454
70	,039773
60	,034091
50	,028409
40	,022727
30	,017045
20	,011364
10	,005682
9	,005114
8	,004545
7	,003977
6	,003409
5	,002841
4	,002273
3	,001704
2	,001136
1	,000568

Feet.	*Decimals.*
2	,0003787
1	,0001894

Inches.	*Decimals.*
6	,0000947
3	,0000474
1	,0000158

TABLE IX.

TIME.

1 Year the Integer.

Months the same as Pence in the second Table.

Days.	*Decimals.*
365	1,000000
300	,821918
200	,547945
100	,273973
90	,246575
80	,219178
70	,191781
60	,164383
50	,136986
40	,109589
30	,082192
20	,054794
10	,027397
9	,024657
8	,021918
7	,019178
6	,016438
5	,013698
4	,010959
3	,008219
2	,005479
1	,002739

1 Day the Integer.

Hours.	*Decimals.*
12	,5
11	,458333
10	,416666
9	,375
8	,333333
7	,291666
6	,25
5	,208333
4	,166666
3	,125
2	,083333
1	,041666

Minutes.	*Decimals.*
30	,020833
20	,013888
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,003777
3	,002083
2	,001388
1	,000694

TABLE X.

CLOTH MEASURE

1 Yard the Integer.

Qrs. the same as Table 4.

Nails.	*Decimals.*
2	,125
1	,0625

TABLE XI.

LEAD WEIGHT.

A Fother the Integ.

Hund.	*Decimals.*
10	,512820
9	,461538
8	,410256
7	,358974
6	,307692
5	,256410
4	,205128
3	,153846
2	,102564
1	,051282

Qrs.	*Decimals.*
2	,025641
1	,012820

Pounds.	*Decimals.*
14	,0064102
13	,0059523
12	,0054945
11	,0050366
10	,0045787
9	,0041208
8	,0036620
7	,0032051
6	,0027472
5	,0022893
4	,0018315
3	,0013736
2	,0009157
1	,0004578

The Rule of Three in Decimals.

EXAMPLES.

If 26 $\frac{1}{2}$ yards cost 3l. 16s. 3d. what will 32 $\frac{1}{4}$ yards come to? *Ans.* 4*l.* 12*s.* 9$\frac{1}{2}$*d.*

Yds. *l.* *Yds.*
26,5 : 3,8125 : : 32,25 :
32,25
26,5)122,953125(4,63974=4*l.* 12*s.* 9$\frac{1}{2}$*d.*

2. What will the pay of 540 men come to at 1l. 5s. 6d. per man? *Ans.* 688*l.* 10*s.*

3. If 7$\frac{3}{4}$ yards of cloth cost 2l. 12s. 9d. what will 140$\frac{1}{2}$ yards of the same cost? *Ans.* 47*l.* 16*s.* 3*d.* 2,4 *qrs.*

4. If a chest of sugar, weighing 7 cwt. 2 qrs. 14 lb. cost 36l. 12s. 9d. what will 2 cwt. 1 qr. 21 lb. of the same cost? *Ans.* 11*l.* 14*s.* 2*d.* 3,5 *qrs.*

5. A grocer buys 24 ton, 12 cwt. 2 qrs. 14 lb. 12 oz. of tobacco for 3678l. 6s. 4d. what will 1 oz. come to? *Ans.* 1*d.*

6. What will 326 lb. 1 qr. of tobacco come to, when 1$\frac{1}{2}$ lb. is sold for 3s. 6d.? *Ans.* 38*l.* 1*s.* 3*d.*

7. What is the worth of 19 oz. 3 dwt. 5 gr. of gold, at 2l. 9s. per oz.? *Ans.* 56*l.* 10*s.* 5*d.* 2,99 *qrs.*

8. What is the worth of 827$\frac{3}{4}$ yards of painting, at 10$\frac{1}{2}$d. per yard? *Ans.* 36*l.* 4*s.* 3*d.* 1,5 *qrs.*

9. If I lent my friend 34l. for $\frac{5}{8}$ of a year, how much ought he to lend me $\frac{5}{12}$ of a year to requite my kindness? *Ans.* 51*l.*

10. If $\frac{3}{4}$ of a yard of cloth, that is 2$\frac{1}{4}$ yards broad, make a garment, how much that is $\frac{4}{5}$ of a yard wide will make the same? *Ans.* 2,109375 *yards.*

11. If 1 oz. of silver cost 5s. 6d. what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwts. 4 grs.? *Ans.* 6*l.* 3*s.* 9*d.* 2,2 *qrs.*

12. If 1 lb. of tobacco cost 15d. what cost 3 hogsheads, weighing together 15 cwt. 1 qr. 19 lb.? *Ans.* 107*l.* 18*s.* 10*d.*

13. If 1 cwt. of currants cost 2l. 9s. 6d. what will 45 cwt. 3 qrs. 14 lb. cost at the same rate? *Ans.* 113*l.* 10*s.* 9*d.* 3*qrs.*

14. Bought 6 chests of sugar, each 6 cwt. 3 qrs. at 2l. 16s. per cwt. what do they come to? *Ans.* 113*l.* 8*s.*

15. Bought a tankard for 10l. 12s. at the rate of 5s. 4d. per ounce, what was the weight? *Ans.* 39 *oz.* 15 *dwts.*

16. Gave 187l. 3s. 3d. for 25 cwt. 3 qrs. 14 lb. of tobacco, at what rate did I buy it at per lb.? *Ans.* 15*d.* 2 *qrs,*

17. Bought 29 lb. 4 oz. of coffee for 10l. 11s. 3d. what is the value of 3 lb.? *Ans.* 1*l.* 1*s.* 8*d.*

18. If I gave 1s. 1d. for 3½ lb. of cheese, what will be the value of 1 cwt.? *Ans.* 1*l.* 14*s.* 8*d.*

Extraction of the Square Root.

Extracting the Square Root is to find out such a number as being multiplied into itself, the product will be equal to the given number.

RULE 1st. Point the given number beginning at the unit's place, then to the hundreds, and so upon every second figure throughout.

2dly. Seek the greatest square number in the first point towards the left-hand, placing the square number under the first point, and the root thereof in the quotient; subtract the square number from the first point, and to the remainder bring down the next point, and call that the resolvend.

3dly. Double the quotient, and place it for a divisor on the left-hand of the resolvend; seek how often the divisor is contained in the resolvend (preserving always the unit's place), and put the answer in the quotient, and also on the right-hand side of the divisor; then multiply by the figure last put in the quotient, and subtract the product from the resolvend; bring down the next point to the remainder (if there be any more) and proceed as before.

ROOTS,	1.	2.	3.	4.	5.	6.	7.	8.	9.
SQUARES,	1.	4.	9.	16.	25.	36.	49.	64.	81.

EXAMPLES.

1. What is the square root of 119025? *Ans.* 345.

```
119025(345
9
------
64)290
   256
-------
685)3425
    3425
```

2. What is the square root of 106929? *Ans.* 327.
3. What is the square root of 2268741? *Ans.* 1506,23+.
4. What is the square root of 7596796? *Ans.* 2756,228+.
5. What is the square root of 36372961? *Ans.* 6031.
6. What is the square root of 22071204? *Ans.* 4698.

When the given number consists of a whole number, and decimals together, make the number of decimals even, by adding ciphers to them; so that there may a point fall on the unit's place of the whole number.

7. What is the square root of 3271,4207? *Ans.* 57,19+.
8. What is the square root of 4795,25731? *Ans.* 69,247+.
9. What is the square root of 4,372594? *Ans.* 2,091+.
10. What is the square root of 2,2710957? *Ans.* 1,50701+.
11. What is the square root of ,00032754? *Ans.* ,01809+.
12. What is the square root of 1,270054? *Ans.* 1,1269+.

To extract the square root *of a* vulgar fraction.

Rule. Reduce the fraction to its lowest terms: then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

If the fraction be a surd (i. e.) *a number where a root can never be exactly found, reduce it to a decimal, and extract the root of it.*

EXAMPLES.

13. What is the square root of $\frac{2304}{5184}$? *Ans.* $\frac{2}{3}$.
14. What is the square root of $\frac{2704}{4225}$? *Ans.* $\frac{4}{5}$.
15. What is the square root of $\frac{9216}{12544}$? *Ans.* $\frac{6}{7}$.

SURDS.

16. What is the square root of $\frac{275}{341}$? *Ans.* ,89802+.
17. What is the square root of $\frac{357}{476}$? *Ans.* ,86602+.
18. What is the square root of $\frac{478}{549}$? *Ans.* ,93308+.

To extract the square root of a mixed number.

RULE 1. Reduce the fractional part of the mixed number to its lowest term, and then the mixed number to an improper fraction.

2. Extract the roots of the numerator and denominator for a new numerator and denominator.

If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root thereof.

EXAMPLES.

19. What is the square root of $51\frac{21}{25}$? *Ans.* $7\frac{1}{5}$.
20. What is the square root of $27\frac{9}{16}$? *Ans.* $5\frac{1}{4}$.
21. What is the square root of $9\frac{43}{49}$? *Ans.* $3\frac{1}{7}$.

SURDS.

22. What is the square root of $85\frac{14}{15}$? *Ans.* 9,27+.
23. What is the square root of $8\frac{5}{7}$? *Ans.* 2,9519+.
24. What is the square root of $6\frac{2}{5}$? *Ans.* 2,5819+.

THE APPLICATION.

1. There is an army consisting of a certain number of men, who are placed rank and file (that is, in the form of a square, each side having 576 men) I desire to know how many the whole square contains? *Ans*, 331776.

2. A certain pavement is made exactly square, each side of which contains 97 feet, I demand how many square feet are contained therein? *Ans.* 9409.

To find the mean proportional between any two given numbers.

RULE. The square root of the product of the given number is the mean proportional sought.

EXAMPLES.

27. What is the mean proportion between 3 and 12?

Ans. 3 × 12 = 36 *then* √ 36 = 6 *the mean proportional.*

28. What is the mean proportional between 4276 and 842? *Ans.* 1897,4+

To find the side of a square equal in area to any given superficies.

Rule. The square root of the content of any given superficies is the square equal sought.

EXAMPLES.

29. If the content of a given circle be 160, what is the side of a square? *Ans.* 12,64911.

30. If the area of a circle is 750, what is the side of the square equal? *Ans.* 27,38612.

The area of a circle given, to find the diameter.

Rule. As 355 : 452, or, as 1 : 1,273239 : : so is the area : to the square of the diameter:—or, multiply the square root of the area, by 1,12837, and the product will be the diameter.

EXAMPLES.

31. What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, supposing the cow and tail be five yards ½? *Ans.* 6,136 *perches.*

The area of a circle given, to find the periphery, or circumference.

Rule. As 113 : 1420, or, as 1 : 12,56637 : : the area to the square of the periphery :—or, multiply the square root of the area by 3,5449, and the product is the circumference.

EXAMPLES.

32. When the area is 12, what is the circumference? *Ans.* 12,2798.

33 When the area is 160, what is the periphery? *Ans.* 44,839,

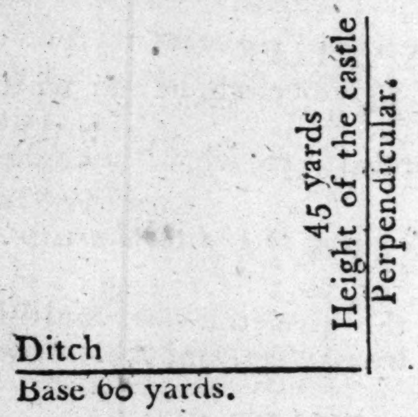
Any two sides of a right angled triangle given, to find the third side.

1. *The base and perpendicular given, to find the hypothenuse.*

Rule. The square root of the sum of the squares of the base and perpendicular is the length of the hypothenuse.

EXAMPLES.

34. The top of a castle from the ground is 45 yards high, and surrounded with a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle? *Ans.* 75 *yards.*



35. The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breath: I desire to know the length of a ladder that will reach from the outside of the moat to the top of the wall? *Ans.* 39,05*feet.*

The hypothenuse and perpendicular given to find the base.

Rule. The square root of the difference of the squares of the hypothenuse and perpendicular is the length of the base.

The base and hypothenuse given, to find the perpendicular.

Rule. The square root of the difference of the squares of the hypothenuse and base is the height of the perpendicular.

☞ *The two last questions may be varied for examples to the two last propositions.*

Any number of men being given to form them into a square battalia, or to find the number of ranks and files.

Rule. The square root of the number of men given, is the number of men either in rank or file.

36. An army consisting of 331776 men, I desire to know how many rank and file? *Ans.* 576.

37. A certain square pavement contains 48841 square stones, all of the same size. I demand how many are contained in one of the sides? *Ans.* 221.

Extraction of the Cube Root.

Rule 1. Point every third figure of the cube given, beginning at the unit's place, then find the highest cube to the first point, and subtract it therefrom, put the root in the quotient, bring down the figures in the next point to the remainder for a resolvend.

2. Square the quotient, and triple the square for a divisor. *As* 4×4×3=48. Find how often it is contained in the resolvend, rejecting units and tens, and put the answer in the quotient.

3. Square the last figure in the quotient, and put it on the right-hand of the divisor.

As 6×6=36 put to the divisor 48=4836.

4. Triple the last figure in the quotient, and multiply by the former, put it under the other, units under the tens, add them together, and multiply the sum by the last figure in the quotient, subtract that product from the resolvend, bring down the next point, and proceed as before.

EXAMPLES.

1. What is the cube root of 99252847?

Square of 4×3=48 *divisor.*	99252847(463
Square of 6 *put to* 48=4836	64
6×3×4=72	
	35252
5556×6=	33336
Square of 46=2116×3=6348 *divisor.*	
Square of 3=9 *put to* 6348=*634809	1916847
3×3×46=414	
638949×3=1916847.	

---

* *When the quotient is* 2 *or* 3, *there must be a cipher put to supply the place of tens.*

2. What is the cube root of 389017? *Ans.* 73.
3. What is the cube root of 5735339? *Ans.* 179.
4. What is the cube root of 32461759? *Ans.* 319.
5. What is the cube root of 84604519? *Ans.* 439.
6. What is the cube root of 259694072? *Ans.* 638.
7. What is the cube root of 48228544? *Ans.* 364.
8. What is the cube root of 27054036008? *Ans.* 3002.
9. What is the cube root of 22069810125? *Ans.* 2805.
10. What is the cube root of 122615327232? *Ans.* 4968.
11. What is the cube root of 219365327791? *Ans.* 6031.
12. What is the cube root of 673373097125? *Ans.* 8765.

1. *When the given number consists of a whole number and decimal together, make the number of decimals consist of* 3, 6, 9, *&c. places, by adding ciphers thereto, so that there may be a point fall on the unit's place of the whole number.*

13. What is the cube root of 12,977875? *Ans.* 2,35.
14. What is the cube root of 36155,027576? *Ans.* 33,06+.
15. What is the cube root of ,001906624? *Ans.* ,124.
16. What is the cube root of 33,230979637? *Ans.* 3,215+.
17. What is the cube root of 15926,972504? *Ans.* 25,16+.
18. What is the cube root of ,053258279? *Ans.* ,376.

To extract the cube root of a vulgar fraction.

Rule. Reduce the fraction to its lowest terms, then extract the cube root of the numerator and denominator, for a new numerator and denominator; but if the fraction be a surd, reduce it to a decimal, and then extract the root from it.

EXAMPLES.

19. What is the cube root of $\frac{250}{686}$? *Ans.* $\frac{5}{7}$
20. What is the cube root of $\frac{324}{1500}$? *Ans.* $\frac{3}{5}$
21. What is the cube root of $\frac{1520}{5130}$? *Ans.* $\frac{2}{3}$

SURDS.

22. What is the cube root of $\frac{4}{7}$? *Ans.* ,829+.
23. What is the cube root of $\frac{5}{9}$? *Ans.* ,822+.
24. What is the cube root of $\frac{2}{3}$? *Ans.* ,873+.

To extract the cube root of a mixed number.

Rule. Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction, extract the cube roots of the numerator and denominator for a new numerator and denominator; but if the mixed number given be a surd, reduce the fractional part to decimals, annex it to the whole number, and extract the root therefrom.

EXAMPLES.

25. What is the cube root of $12\frac{19}{27}$?	*Ans.* $2\frac{1}{3}$.
26. What is the cube root of $31\frac{15}{343}$?	*Ans.* $3\frac{1}{7}$.
27. What is the cube root of $405\frac{28}{125}$?	*Ans.* $7\frac{2}{5}$.

SURDS.

28. What is the cube root of $7\frac{1}{5}$?	***Ans.* 1,93+.**
29. What is the cube root of $9\frac{1}{6}$?	***Ans.* 2,092+.**
30. What is the cube root of $8\frac{5}{7}$?	***Ans.* 2,057+.**

THE APPLICATION.

1. If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep, how many cubical inches doth it contain? *Ans.* 103823.

2. There is a cellar dug, that is 12 feet every way, in length, breadth, and depth, how many solid feet of earth were taken out of it? *Ans.* 1728.

3. There is a stone of a cubic form, which contains 389017 solid feet, what is the superficial content of one of its sides? *Ans.* 5329.

Between two numbers given to find two mean proportionals.

RULE. Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme gives the less mean; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

EXAMPLES.

4. What are the two mean proportionals between 6 and 162? *Ans.* 18 *and* 54.

5. What are the two mean proportionals between 4 and 108? *Ans.* 12. *and* 36.

To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.

RULE. The cube root of the solid content of any solid body given, is the side of the cube of equal solidity.

EXAMPLES.

EXAMPLES.

6. If the solid content of a globe is 10648, what is the side of a cube of equal solidity? *Ans.* 22.

The side of the cube being given, to find the side of the cube that shall be double, treble, &c. in quantity to the cube given.

Rule. Cube the side given, and multiply it by 2, 3, &c. the cube root of the product is the side sought.

EXAMPLE.

7. There is a cubical vessel, whose side is 12 inches, and it is required to find the side of another vessel, that is to contain 3 times as much? *Ans.* 17,306.

Extracting of the Biquadrate Root.

To extract the Biquadrate Root is to find out a number, which being involved four times into itself will produce the given number.

Rule. First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

EXAMPLES.

1. What is the biquadrate of 27? *Ans.* 531441.
2. What is the biquadrate of 76? *Ans.* 33362176.
3. What is the biquadrate of 275? *Ans.* 5719140625.
4. What is the biquadrate root of 531441? *Ans.* 27.
5. What is the biquadrate root of 33362176? *Ans.* 76.
6. What is the biquadrate root of 5719140625? *Ans.* 275.

A general Rule for Extracting the Roots of all Powers.

1. Prepare the number given for extraction, by pointing off from the unit's place as the root required directs.

2. Find the first figure in the root by the table of powers, which subtract from the given number.

3. Bring down the first figure in the next point to the remainder, and call it the dividend.

4. Involve the root into the next inferior power to

that which is given, multiply it by the given power, and call it the divisor.

5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.

6. Subtract that number from as many points of the given power as are brought down, beginning at the lowest place, and to the remainder bring down the first figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

EXAMPLES.

1. What is the square root of 141376?

. . .
141376(376
9
—
6)51 *dividend.*
1369 *subtrahend.*
74) 447 *dividend.*
141376 *subtrahend.*

3 × 2=6 *divisor.*
37 × 37=1369 *subtrahend.*
37 × 2=74 *divisor.*
376 × 376=141376 *subtrahend.*

2. What is the cube root of 53157376?

53157376(376
27
27)261 *dividend.*
50653 *subtrahend.*
4107)25043 *dividend.*
53157376 *subtrahend.*

3 × 3 × 3= 27 *divisor.*
37 × 37 × 37= 50653 *subtrahend.*
37 × 37 × 3= 4107 *divisor.*
376 × 376 × 376=53157376 *subtrahend.*

3. What is the biquadrate root of 19987173376?

$$\begin{array}{l}
\quad\ \ \dot{1}99\dot{8}71\dot{7}3376(376 \\
\quad\ \ \ 81 \\
\hline
\quad 108)1188 \textit{ dividend.} \\
\hline
\quad 1874161 \textit{ subtrahend.} \\
\hline
202612)1245563 \textit{ dividend.} \\
\hline
\quad 19987173376 \textit{ subtrahend.} \\
\hline
\end{array}$$

3 × 3 × 3 × 4=108 *divisor.*
37 × 37 × 37 × 37=1874161 *subtrahend.*
37 × 37 × 37 × 4=202612 *divisor.*
376 × 376 × 376 × 376=19987173376 *subtrahend.*

Simple Interest.

There are five letters to be observed in simple interest, *viz.*

P. the Principal.
T. the Time.
R. the Ratio, or Rate *per cent.*
I. the Interest.
A. the Amount.

A TABLE OF RATIOS.

3	,03	5½	,055	8	,08
3½	,035	6	,06	8½	,085
4	,04	6½	,065	9	,09
4½	,045	7	,07	9½	,095
5	,05	7½	,075	10	,1

☞ *The* ratio *is the simple interest of* 1*l. for one year, at the* rate per cent. *proposed, and is found thus:*

l. l. l.
As 100 : 3 : : 1 : ,03   *As* 100 : 3,5 : : 1 : ,035.

When the principal, time, and rate per cent. *are given, to find the interest.*

Rule. Multiply the principal, time, and rate together, and it will give the interest required.

Note. *The proposition and rule are better expressed thus:*

I. *When* P. T. R. *are given, to find* I.

Rule, *prt.*=I.

☞ *When two or more letters are put together like a word, they are to be multiplied one into another.*

EXAMPLES.

1. What is the interest of 945l. 10s. for three years, at 5 per cent. per annum?
Ans. 945*l.* ,5×,05×3=141,825 *or* 141*l.* 16*s.* 6*d.*

2. What is the interest of 547l. 14s. at 4 per cent. per annum, for 6 years? *Ans.* 131*l.* 8*s.* 11*d.* 2 *qr.* 08.

3. What is the interest of 796l. 15s. at 4½ per cent. per annum for 5 years? *Ans.* 179*l.* 5*s.* 4*d.* 2 *qr.*

4. What is the interest of 397l. 9s. 5d. for two years and ½, at 3½ per cent. per ann.? *Ans.* 34*l.* 15*s.* 6*d.* 3,5472 *qr.*

5. What is the interest of 554l. 17s. 6d. for 3 years, 8 months, at 4½ per cent. per ann.?
Ans. 91*l.* 11*s.* 201969 *qr.*

6. What is the interest of 236l. 18s. 8d. for 3 years, 8 months, at 5½ per cent. per annum?
Ans. 47*l.* 15*s.* 7*d.* 1,4528 *qr.*

When the interest is for any number of days only.

Rule. Multiply the interest of 1l. for one day, at the given rate, by the principal and number of days, it will give the answer.

Interest *of* 1l. *for one* Day.

per Cent.	*Decimals.*	*per Cent.*	*Decimals.*
3	,00008219178	6½	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958004	7½	,00020547945
4½	,00012328767	8	,00021917808
5	,00013698630	8½	,00023287671
5½	,00015068493	9	,00024657534
6	,00016438356	9½	,00026027397

Note. *The above table is thus found:*
As 365 : ,03 : : 1 : ,00008219178. *And as* 365 : ,035 : : 1 : ,00009589041, *&c.*

EXAMPLES.

7. What is the interest of 240l. for 120 days, at 4 per cent. per annum? *Ans.* 00010958904 × 240 × 120 = 3*l.* 3*s.* 1¼*d.*

8. What is the interest of 563l. at 6 per cent. per annum for 126 days? *Ans.* 11*l.* 13*s.* 2½*d.*

9. What is the interest of 560l. for 60 days, at 5 per cent. per annum? *Ans.* 4*l.* 12*s.* 0½*d.*

10. What is the interest of 364l. 18s. for 154 days, at 5 per cent. per annum? *Ans.* 7*l.* 13*s* 11¼*d.*

11. What is the interest of 725l. 15s for 74 days, at 4 per cent. per annum? *Ans.* 5*l.* 17*s.* 8¼*d.*

12. What is the interest of 100l. from the 1st of June, 1794, to the 9th of March following, at five per cent. per annum? *Ans.* 3*l.* 16*s.* 11¾*d.*

II. *When* P. R, T, *are given, to find* A.

Rule. $prt+p=A$.

EXAMPLES.

13. What will 279l. 12s. amount to in 7 years, at 4½ per cent. per annum? *Ans.* 367*l.* 13*s.* 5*d.* 3,04 *qrs.*

279,6 × ,045 × 7 + 279,6 = 367,674.

14. What will 320l. 17s. amount to in 5 years, at 3½ per cent. per annum? *Ans.* 376*l.* 19*s.* 11*d.* 2,8 *qrs.*

15. What will 679l. 13s. amount to in 6 years, at 5 per cent. per annum? *Ans.* 883l. 10*s.* 10*d.* 3,2 *qrs.*

When there is any odd time given with the whole years, reduce the odd time into days, and work with the decimal parts of a year which are equal to those days.

16. What will 926l. 12s. amount to in 5½ years, at 4 per cent. per annum? *Ans.* 1130*l.* 9*s.* 1,92 *qrs.*

17. What will 368l. 16s. amount to in 7¾ years, at 6½ per cent. per annum? *Ans.* 554*l.* 11*s.* 7*d.* 3,68 *qrs.*

18. What will 273l. 18s. amount to in 4 years, 175 days, at 3 per cent. per annum?

Ans. 310*l.* 14*s.* 1*d.* 3,35080064 *qrs.*

III. *When* A, R, T, *are given to find* P.

Rule. $\dfrac{a}{rt \times 1}=P$.

EXAMPLES.

EXAMPLES.

19. What principal, being put to interest, will amount to 367l. 13s. 5d. 3,04 qrs. in 7 years, at 4½ per cent. per annum? *Ans.* $,045\times 7+1=1,315$, *then* $367,674\div 1,315=279$*l.* 12*s.*

20. What principal, being put to interest, will amount to 376l. 19s. 11d. 2,8 qrs. in 5 years, at 3½ per cent. per annum? *Ans.* 320*l.* 17*s.*

21. What principal, being put to interest, will amount to 883l. 10s. 10d. 3,2 qrs. in 6 years, at 5 per cent. per annum? *Ans.* 679*l.* 13*s.*

22. What principal, being put to interest, will amount to 1130l. 9s. 1,92 qrs. in 5½ years, at 4 per cent. per annum? *Ans.* 926*l.* 12*s.*

23. What principal will amount to 554l. 11s. 7d. ,368 qrs. in 7¾ years, at 6½ per cent. per annum? *Ans.* 368*l.* 16*s.*

24. What principal will amount to 310l. 14s. 1d. 3,35080064 qrs. in 4 years, 175 days, at 3 per cent. per annum? *Ans.* 273*l.* 18*s.*

IV. *When* A, P, T, *are given, to find* R.

Rule. $\frac{a-p}{pt}=R.$

EXAMPLES.

25. At what rate per cent. will 279l. 12s. amount to 367l. 13s. 5d. 3,04 qrs. in 7 years?

Ans. $367,674-279,6=88,074$. $279,6\times 7=1957,2$, *then* $88,074\div 1957,2=,045$, *or* 4½ *per cent.*

26. At what rate per cent. will 320l. 17s. amount to 376l. 19s. 11d. 2,8 qrs. in 5 years? *Ans.* 3½ *per cent.*

27. At what rate per cent. will 679l. 13s. amount to 883l. 10s. 10d. 3,2 qrs. in 6 years? *Ans.* 5 *per cent.*

28. At what rate per cent. will 926l. 12s. amount to 1130l. 9s. 1,92 qrs. in 5½ years? *Ans.* 4 *per cent.*

29. At what rate per cent. will 368l. 16s. amount to 554l, 18s. 7d. 3,68 qrs. in 7¾ years? *Ans.* 6½ *per cent.*

30. At what rate per cent. will 273l. 18s. amount to 310l. 14s. 1d. 3,35080064 qrs. in 4 years, 175 days? *Ans.* 3 *per cent.*

V. *When* A, P, R, *are given, to find* T.

Rule. $\frac{a-p}{pr}=T.$

EXAMPLES.

31. In what time will 279l. 12s. amount to 367l. 13s. 5d. 3,04 qrs. at $4\frac{1}{2}$ per cent.? *Ans.* $367,674 \div 279,6 = 88,074$. $279,6 \times ,045 = 12,5820$. *then* $88,074 = 12,5820 = 7$ *years.*

32. In what time will 320l. 17s. amount to 376l. 19s. 11d. 1,8 qrs. at $3\frac{1}{2}$ per cent.? *Ans.* 5 *years.*

33. In what time will 679l. 13s. amount to 883l. 10s. 10d. 3,2 qrs. at 5 per cent.? *Ans.* 6 *years.*

34. In what time will 926l. 12s. amount to 1130l. 9s. 1,92 qrs. at 4 per cent.? *Ans.* $5\frac{1}{2}$ *years.*

35. In what time will 368l. 16s. amount to 554l. 11s. 7d. 3,68 qrs. at $6\frac{1}{2}$ per cent.? *Ans.* $7\frac{3}{4}$ *years.*

36. In what time will 273l. 18s. amount to 310l. 14s. 1d. 35,5080064 qrs. at 8 per cent.? *Ans.* 4 *years,* 175 *days.*

Annuities, or Pensions, &c. in Arrears.

Annuities, or pensions, &c. are said to be in arrears, when they are payable or due, either yearly, half yearly, or quarterly, and are unpaid for any number of payments.

Note. U *represents the* annuity, pension, *or* yearly rent.

T, R, A, *as before.*

I. U, R, T, *are given, to find* A.

Rule. $\frac{ttu - tu}{2} \times r : + tu = A.$

EXAMPLES.

37. If a salary of 150l. be forborne 5 years, at 5 per cent. what would it amount to? *Ans.* 825*l.*

$$\overline{5 \times 5 \times 150 - 5 \times 150} = 3000 \text{ then } \frac{3000}{2} \times ,05 + 5 \times 150 = 825l.$$

38. If 250l. yearly pension be forborne 7 years, what will it amount to in that time, at 6 per cent.? *Ans.* 2065*l.*

39. There is a house lett upon a lease for $5\frac{1}{2}$ years, at 60l. per annum, what will be the amount of the whole time, at $4\frac{1}{2}$ per cent.? *Ans.* 363*l.* 8*s.* 3*d.*

40. Suppose an annual pension of 28l. remain unpaid for 8 years, what would it amount to at 5 per cent.? *Ans.* 263*l.* 4*s.*

Note. *When the annuities, &c. are to be paid half yearly, or quarterly, then*

For half-yearly payments, *take half of the ratio, half of the annuity, &c. and twice the number of years,—and*

For quarterly payments, *take a fourth part of the ratio, a fourth part of the annuity, &c. and four times the number of years, and work as before.*

EXAMPLES.

41. If a salary of 150l. payable every half year, remains unpaid for 5 years, what would it amount to in that time, at 5 per cent.? *Ans.* 834*l.* 7*s.* 6*d.*

42. If a salary of 150l. payable every quarter, was left unpaid for 5 years, what would it amount to in that time, at 5 per cent.? *Ans.* 839*l.* 1*s.* 3*d.*

Note. *It may be observed, by comparing these last examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly more than the half-yearly.*

II. *When* A, R, T, *are given, to find* U.

Rule. $$\frac{2a}{ttr - tr + 2t} = U.$$

EXAMPLES.

43. If a salary amounted to 825l. in 5 years, at 5 per cent. what was the salary? *Ans.* 150*l.*

$825 \times 2 = 1650.$ $5 \times 5 \times ,05 - 5 \times ,05 + 5 \times 2 = 11$ *then* $1650 \div 11 = 150$*l.*

44. If a house is to be lett upon a lease for $5\frac{1}{2}$ years, and the amount for the time be 363l. 8s. 3d. at $4\frac{1}{2}$ per cent. what is the yearly rent? *Ans.* 60*l.*

45. If a pension amounted to 2065l. in 7 years, at 6 per cent. what was the pension? *Ans.* 250*l.*

46. Suppose the amount of a pension be 263l. 4s. in 8 years, at 5 per cent. what is the pension? *Ans.* 28*l.*

Note. *When the payments are half-yearly, then take* 4 a *and half of the ratio, and twice the number of years; and if quarterly, then take* 8 a, *one fourth of the ratio, and four times the number of years, and proceed as before.*

47. If the amount of a salary, payable half yearly, for 5 years, and at 5 per cent. be 834l. 7s. 6d. what is the salary? *Ans.* 150*l.*

48. If the amount of an annuity, payable quarterly, be 839l. 1s. 3d. for 5 years, at 5 per cent. what is the annuity? *Ans.* 150*l.*

III. *When* U, A, T, *are given, to find* R.

Rule. $\frac{2a-2ut}{utt-ut}=R$.

EXAMPLES.

49. If a salary of 150l. per annum amount to 825l. in 5 years, what is the rate per cent.? *Ans.* 5 *per cent.*

$$\overline{825\times2}-\overline{150\times5\times2}=150 \text{ then } \frac{150}{\overline{150\times5\times5}-\overline{150\times5}}=.05.$$

50. If a house be lett upon lease for $5\frac{1}{2}$ years, at 60l. per annum, and the amount for that time be 363l. 8s. 3d. what is the rate per cent.? *Ans.* $4\frac{1}{2}$ *per cent.*

51. If a pension of 250l. per annum amount to 2025l. in 7 years, what is the rate pet cent? *Ans.* 6 *per cent.*

52. Suppose the amount of a yearly pension of 28l. be 263l. 4s. in 8 years, what is the rate per cent.? *Ans.* 5 *per cent.*

Note. *When the payments are half-yearly, take* 4 a—4 ut *for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly, take* 8 a—8 ut, *and work with a fourth of the annuity, and four times the number of years.*

53. If a salary of 150l. per annum, payable half yearly, amounts to 834l. 7s. 6d. in 5 years, what is the rate per cent.? *Ans.* 5 *per cent.*

54. If an annuity of 150l. per annum, payable quarterly, amounts to 839l. 1s. 3d. in 5 years, what is the rate per cent.? *Ans.* 5 *per cent.*

IV. *When* U, A, R, *are given, to find* T.

Rule. *First,* $\frac{2}{r}-1=x$ *then* $\sqrt{\frac{2a}{ur}+\frac{xx}{4}}:-\frac{x}{2}=T$.

EXAMPLES.

55. In what time will a salary of 150l. per annum amount to 825l. at 5 per cent.? *Ans.* 5 *years.*

$$\frac{2}{,05} - 1 = 39 \quad \frac{825 \times 2}{150 \times ,05} = 220 \quad \frac{39 \times 39}{4} = 380,25$$

$$\sqrt{220 + 380,25} = 24,5 - \frac{39}{2} = 5 \text{ years.}$$

56. If an house is let upon lease for a certain time for 60l. per annum, and the amount be 363l. 8s. 3d. at 4½ per cent. what time was it let for? *Ans.* 5½ *years.*

57. If a pension of 250l. per annum, being forborne a certain time, amounts to 2065l. at 6 per cent. what was the time of forbearance? *Ans.* 7 *years.*

58. In what time will a yearly pension of 28l. amount to 263l. 4s. at 5 per cent.? *Ans.* 8 *years.*

Note. *If the payments are half-yearly, take half the ratio and half the annuity; if quarterly, one fourth of the ratio and one fourth of the annuity; and* T *will be equal to those half-yearly or quarterly payments.*

59. If an annuity of 150l. per annum, payable half-yearly, amounts to 834l. 7s. 6d. at 5 per cent. what time was the payment forborne? *Ans.* 5 *years.*

60. If a yearly pension of 150l. payable quarterly, amounts to 839l. 1s. 3d. at 5 per cent. what was the time of forbearance? *Ans.* 5 *years.*

PRESENT WORTH OF ANNUITIES.

Note. P *represents the present worth;* U, T, R, *as before.*

I. *When* U, T, R, *are given, to find* P.

RULE. $\frac{ttr - tr + 2t}{2tr + 2} : u. = P.$

EXAMPLES.

61. What is the present worth of 250l. per annum, to continue 5 years, at 5 per cent.? *Ans.* 660*l.*

$5 \times 5 \times ,05 - 5 \times ,05 + 5 \times 2 = 11. \quad 5 \times ,05 \times 2 + 2 = 2,5$

then $11 \div 2,5 \times 150 = 660l.$

62. What is the yearly rent of a house of 60l. to continue 5½ years, worth in ready money, at 4½ per cent.? *Ans.* 291*l.* 6*s.* 3*d.*

63. What is the present worth of 250l. per annum, to continue 7 years, at 6 per cent.? *Ans.* 1454*l.* 4*s.* 6*d.*

64. What is a pension of 28l. per annum, worth in ready money, at 5 per cent. for 8 years? *Ans.* 188*l.*

☞ *The same thing is to be observed in the first rule of annuities in arrears, concerning half-yearly and quarterly payments.*

65. What is the present worth of 150l. payable half-yearly, for 5 years, at 5 per cent.? *Ans.* 667*l.* 10*s.*

66. What is the present worth of 150l. payable quarterly, for 5 years, at 5 per cent.? *Ans.* 671*l.* 5*s.*

Note. *By comparing the last examples it will be found, that the present worth of half-yearly payments is more advantageous than yearly; and quarterly, than half-yearly.*

II. *When* P, T, R, *are given, to find* U.

Rule. $\frac{tr+1}{ttr-tr+2t} : \times 2p = U.$

EXAMPLES.

67. If the present worth of a salary be 660l. to continue 5 years, at 5 per cent. what was the salary? *Ans.* 150*l.*

$$\overline{5\times,05}+1=1,25. \quad \overline{5\times5\times,05}-\overline{5\times,05}+10=11.$$

$$then \frac{1,25}{11}\times660\times2=150.$$

68. There is an house let upon lease for $5\frac{1}{2}$ years to come, I desire to know the yearly rent, when the present worth, at $4\frac{1}{2}$ per cent. is 291l. 6s. 3d.? *Ans.* 60*l.*

69. What annuity is that which for 7 years continuance, at 6 per cent. produces 1454l. 4s. 6d. present worth? *Ans.* 250*l.*

70. What annuity is that which for 8 years continuance produces 188l. for the present worth, at 5 per cent.? *Ans.* 28*l.*

Note. *When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by* 4 p; *and when quarterly, take one fourth of the ratio, four times the number of years, and multiply by* 8 p.

71. There is an annuity, payable half-yearly, for 5 years to come, what is the yearly rent, when the present worth, at 5 per cent. is 667l. 10s. 4d.? *Ans.* 150*l.*

72. There is an annuity, payable quarterly, for 5 years

to come, I desire to know the yearly income, when the present worth, at 5 per cent. is 671l. 5s. *Ans.* 150*l.*

III. *When* U, P, T, *are given, to find* R.

Rule. $$\frac{\overline{ut-p}\times 2}{2pt.+ut-utt.}=R.$$

EXAMPLES.

73. At what rate per cent. will an annuity of 150l. per annum, to continue 5 years, produce the present worth of 660l.? *Ans.* 5 *per. cent.*

$$\overline{150\times 5-660}\times 2=180.\ \overline{2\times 660\times 5+150\times 5-150\times 5\times 5}$$
$$=3600 \text{ then } 180\div 3600=,05=5 \text{ per cent.}$$

74. If a yearly rent of 60l. per annum, to continue $5\frac{1}{2}$ years, produce 291l. 6s. 3d. for the present worth, what is the rate per cent.? *Ans.* $4\frac{1}{2}$ *per cent.*

75. If an annuity of 250l. per annum, to continue 7 years, produce 1454l. 4s. 6d. for the present worth, what is the rate per cent.? *Ans.* 6 *per cent.*

76. If a pension of 28l. per annum, to continue 8 years, produces 188l. for the present worth, what is the rate per cent.? *Ans.* 5 *per cent.*

Note. *When the annuities, or rents, &c. are to be paid half-yearly, or quarterly, then*

For half-yearly payments, *take half of the annuity, &c. and twice the number of years, the quotient will be the ratio of half the rate per cent.—and,*

For quarterly payments, *take a fourth part of the annuity, &c. and four times the number of years, the quotient will be the ratio of a fourth part of the rate per cent.*

77. An annuity of 150l. per annum, payable half-yearly, having 5 years to come, is sold for 667l. 10s. what is the rate per cent.? *Ans.* 5 *per cent.*

78. If an annuity of 150l. per annum, payable quarterly, having 5 years to come, is sold for 671l. 5s. what is the rate per cent.? *Ans.* 5 *per cent.*

IV. *When* U, P, R, *are given, to find* T.

Rule. $$\overline{\frac{2}{r}-\frac{2p}{u}}-1=x \text{ then } \sqrt{\overline{\frac{2p}{ur}+\frac{xx}{4}}}-\frac{x}{2}=T$$

EXAMPLES.

79. If an annuity of 150l. per annum produce 660l. for the present worth, at 5 per cent. what is the time of its continuance? *Ans.* 5 *years.*

$$\overline{\frac{2}{,05} - \frac{660 \times 2}{150}} - 1 = 30,2 \qquad \frac{660 \times 2}{150 \times ,05} = 176$$

$$\frac{30,2 \times 30,2}{4} = 228,01 \quad \text{then} \quad \sqrt{228,01 + 176} = 20,1$$

$$20,1 - \frac{30,2}{2} = 5 \text{ years.}$$

80. For what time may a salary of 60l. be purchased for 291l. 6s. 3d. at 4½ per cent.? *Ans.* 5½ *years.*

81. For how long time may 250l. per annum be purchased for 1454l. 4s. 6d. at 6 per cent.? *Ans.* 7 *years.*

82. What time may a pension of 28l. per annum be bought for 188l. at 5 per cent.? *Ans.* 8 *years.*

Note. *When the payments are half-yearly, then* U *will be equal to the half annuity, &c.* R, *half the ratio, and* T *the number of payments; and*

When the payments are quarterly, U *will be equal to a fourth part of the annuity, &c.* R *the fourth of the ratio, and* T *the number of payments.*

83. If an annuity of 150l. per annum, payable half-yearly, is sold for 667l. 10s. at 5 per cent. I desire to know the number of payments, and the time to come? *Ans.* 10 *payments,* 5 *years.*

84. An annuity of 150l. per annum, payable quarterly, is sold for 671l. 5s. at 5 per cent. what is the number of payments and time to come? *Ans.* 20 *payments,* 5 *years.*

ANNUITIES, &c. TAKEN IN REVERSION.

1. *To find the present worth of an annuity, taken in reversion.*

Rule. Find the present worth of the yearly sum at the given rate, and for the time of its continuance, *thus*

$$\frac{ttr - tr + 2t}{2tr + 2} : \times u = P.$$

2. Change P into A, and find what principal being put to interest will amount to A at the same rate, and for the time to come, before the annuity, &c. commences, *thus*,

$$\frac{a}{tr+1}=P.$$

EXAMPLES.

85. What is the present worth of an annuity of 150l. per annum, to continue 5 years, but not to commence till the end of 4 years, allowing 5 per cent. to the purchaser? *Ans.* 550.

$$\frac{5\times5\times{,}05-5\times{,}05+2\times5}{5\times{,}05\times2+2}=4{,}4\times150=\times\frac{660}{4\times{,}05+1}=550$$

86. What is the present worth of a lease of 50l. per annum, for 8 years, but not to commence till the end of 5 years, allowing 4 per cent. to the purchaser?
Ans. 152*l.* 5*s.* 11*d.* 3 *qrs.*

87. A person having the promise of a pension of 20l. per annum, for 8 years, but not to commence till the end of 4 years, is willing to dispose of the same, at 5 per cent. what will be the present worth? *Ans.* 111*l.* 18*s.* 1*d.* 14+.

88. A legacy of 40l. being left for 6 years to a person of 15 years of age, but not to commence till he is 21; he, wanting money, is desirous of selling the same at 4 per cent. what is the present worth? *Ans.* 171*l.* 14*s.*

2. *To find the yearly income of an annuity, &c. in reversion.*

RULE 1. Find the amount of the present worth at the given rate, and for the time before the the reversion, *thus*,

$$ptr+p=A.$$

2. Change A into P, and find what annuity being sold will produce P at the same rate, and for the time of its continuance, *thus*,

$$\frac{tr+1}{ttr-tr+2t}:\times2p=U.$$

EXAMPLES.

89. A person having an annuity left him for 5 years, which does not commence till the end of 4 years, disposed of it for 550l. allowing 5 per cent. to the purchaser, what was the yearly income? *Ans.* 150*l.*

$$\frac{}{550\times4\times,05+550}=666\quad\frac{5\times,05\times1,}{5\times5\times,05-5\times,05+5\times2}$$

$$=,113636\times660\times2=150l.$$

90. There is a lease of an house taken for 4 years, but not to commence till the end of 5 years, the lessee would sell the same for 152l. 6s. present payment, allowing 4 per cent. to the purchaser, what is the yearly rent? *Ans.* 50*l.*

91. A person having the promise of a pension for 8 years, which does not commence till the end of 4 years, has disposed of the same for 111l. 18s. 1d. 14, present money, allowing 5 per cent. to the purchaser, what was the pension? *Ans.* 20*l.*

92. There is a certain legacy left to a person of 15 years of age, which is to be continued for 6 years, but not to commence till he arrives at the age of 21; he wanting a sum of money, sells it for 171l. 14s. allowing 4 per cent. to the buyer, what was the annuity left him? *Ans.* 40*l.*

Rebate or Discount.

S represents the sum to be discounted.
P the present worth.
T the time.
R the ratio.

I. *When* S, T, R, *are given, to find* P.

RULE. $\frac{s}{tr+1}=P.$

EXAMPLES.

1. What is the present worth of 357l. 10s. to be paid 9 months hence, at 5 per cent? *Ans.* 344*l.* 11*s.* 6*d.* 3,168 *qrs.*

$$\frac{357,5}{,75,05+1}=344,5783$$

2. What is the present worth of 275l. 10s. due 7 months hence, at 5 per cent.? *Ans.* 267*l.* 13*s.* 10. ,164*d.*

3. What is the present worth of 875l. 5s. 6d. due 5 months hence, at $4\frac{1}{2}$ per cent.? *Ans.* 859*l.* 3*s.* 3*d.* 3,2544 *qrs.*+

4. How much ready money can I receive for a note of 75l. due 15 months hence, at 5 per cent.? *Ans.* 70*l.* 11*s.* 9. ,1752*d.*

II. *When* P, T, R, *are given, to find* S.

RULE. $ptr+p=S$.

EXAMPLES.

5. If the present worth of a sum of money, due 9 months hence, allowing 5 per cent. be 344l. 11s. 6d. 3168 qrs. what was the sum first due? *Ans.* 357*l.* 10*s.*

$$344{,}4783\times{,}75\times{,}05+344{,}5783=357l.\ 10s.$$

6. A person owing a certain sum, payable 7 months hence, agrees with the creditor to pay him down 267l. 13s. 10. ,164d. allowing 5 per cent. for present payment, what is the debt? *Ans.* 275*l.* 10*s.*

7. A person receives 859l. 3s. 3d. 3,254 qrs. for a sum of money due 5 months hence, allowing the debtor 4½ per cent. for present payment, what was the sum due? *Ans.* 875*l.* 5*s.* 6*d.*

8. A person paid 70l. 11s. 9d. ,1752 for a debt due 15 months hence, he being allowed 5 per cent. for the discount, how much was the debt? *Ans.* 75*l.*

III. S, P, T, *are given, to find* R.

RULE. $\frac{s-p}{tp}=R$.

EXAMPLES.

9. At what rate per cent. will 357l. 10s. payable 9 months hence, produce 344l. 11s. 6d. 3,168 qrs. for present payment? *Ans.* 5 *per cent.*

$$\frac{357{,}5-344{,}5783}{344{,}5783\times{,}75}={,}05=5\ \textit{per cent.}$$

10. At what rate per cent. will 275l. 10s. payable 7 months hence, produce 267l. 13s. 10 ,164d. for present payment? *Ans.* 5 *per cent.*

11. At what rate per cent. will 875l. 5s. 6d. payable 5 months hence, produce the present payment of 859l. 3s. 3d. 3,2544 qrs. *Ans.* 4½ *per cent.*

12. At what rate per cent. will 75l. payable 15 months hence, produce the present payment of 70l. 11s. 9. ,1752d. *Ans.* 5 *per cent.*

IV. *When*

IV. *Wnen* S, P, R, *are given, to find* T.

Rule. $\frac{s-p}{rp}=\mathrm{T}$.

EXAMPLES.

13. The present worth of 357l. 10s. due for a certain time to come, is 344l. 11s. 6d. 3,168 qrs. at 5 per cent. in what time should the sum have been paid, without any rebate? *Ans.* 9 *months.*

$$\frac{357{,}5-344{,}5783}{344{,}5783\times{,}05}={,}75=9 \text{ months.}$$

14. The present worth of 275l. 10d. due for a certain time to come, is 267l. 13s. 10. ,164d. at 5 per cent. in what time should the sum have been paid without any rebate? *Ans.* 7 *months.*

15. A person receives 859l. 3s. 3d. 3,2544 qrs. for 875l. 5s. 6d. due at a certain time to come, allowing 4½ per cent. discount; I desire to know in what time the debt should have been discharged without any rebate? *Ans.* 5 *months.*

16. I have received 70l. 11s. 9. ,1752d. for a debt of 75l. allowing the person 5 per cent. for prompt payment; I desire to know when the debt would have been payable without the rebate? *Ans.* 15 *months.*

Equation of Payments.

To find the equated time for the payment of a sum of money due at several times.

Rule. Find the present worth of each payment for its respective time, *thus*, $\frac{s}{tr+1}=\mathrm{P}$.

Add all the present worths together, *then* $s-p=\mathrm{D}$.

$$\frac{d}{pr}=\mathrm{E}.$$

EXAMPLES.

1. D owes E 200l. whereof 40l. is to be paid at 3 months, 60l. at 6 months, and 100l. at 9 months; at

what time may the whole debt be paid together, rebate being made at 5 per cent. *Ans.* 6 *months*, 26 *days.*

$$\frac{40}{1,0125}=39,5061 \quad \frac{60}{1,025}=58,5365 \quad \frac{100}{1,0375}=96,3855$$

$$\text{then } 200-39,5061+58,53659+6,3855=5,5719$$

$$\frac{5,5719}{194,4281\times ,05}=,57315=6 \text{ months, } 26 \text{ days.}$$

2. D owes F 800l. whereof 200l. is to be paid in 3 months, 200l. at 4 months, and 400l. at 6 months; but they agreeing to make but one payment of the whole, at the rate of 5 per cent. rebate; the true equated time is demanded? *Ans.* 4 *months*, 22 *days.*

3. E owes F 1200l. which is to be paid as follows; 200l. down, 500l. at the end of 10 months, and the rest at the end of 20 months; but they agreeing to have one payment of the whole, rebate at 3 per cent. the true equated time is demanded? *Ans.* 1 *year*, 11 *days.*

Compound Interest.

The letters made use of in Compound Interest are,

A the amount.
P the principal.
T the time.
R the amount of 1l. for 1 year, at any given rate; which is thus found:

As 100 : 105 : : 1 : 1,05. As 100 : 105,5 : : 1 : 1,055.

A TABLE of the Amount of 1l. for One Year.

Rates per Cent.	*Amts. of 1l.*	*Rates per Cent.*	*Amts. of 1l.*	*Rates per Cent.*	*Amts. of 1l.*
3	1,03	5½	,1055	8	1,08
3½	1,035	6	,106	8½	1,085
4	1,04	6½	,1065	9	1,09
4½	1,045	7	,107	9½	1,095
5	1,05	7½	,1075	10	1,1

A TABLE shewing the amount of 1l. for any number of years under 31, at 5 and 6 per cent. per annum.

Years.	5 *Rates*	6	*Years.*	5 *Rates*	6
1	1,05000	1,06000	16	2,18287	2,54035
2	1,10250	1,12360	17	2,29201	2,69277
3	1,15762	1,19101	18	2,40662	2,85434
4	1,21550	1,26247	19	2,52695	3,02559
5	1,27628	1,33822	20	2,65329	3,20713
6	1,34009	1,41852	21	2,78596	3,39956
7	1,40710	1,50363	22	2,92526	3,60353
8	1,47745	1,59384	23	3,07152	3,81975
9	1,55132	1,68948	24	3,22510	4,04893
10	1,62889	1,79084	25	3,38635	4,29187
11	1,71034	1,89829	26	3,55567	4,54938
12	1,79585	2,01219	27	3,73345	4,82234
13	1,88565	2,12392	28	3,92013	5,11168
14	1,97993	2,26090	29	4,11613	5,41838
15	2,07892	2,39655	30	4,32194	5,74349

☞ *The above table is thus made:* As 100 : 105 : : 1 : 1,05 *for the first year; then.* As 100 : 105 : : 1,05 : 1,025, *second year, &c.*

I. *When* P, T, R, *are given, to find* A.

Rule. $p \times r^{t} = A$.

EXAMPLES.

1. What will 225l. amount to in 3 years time, at 5 per cent. per ann.? *Ans.* $1{,}05 \times 1{,}05 \times 1{,}05 = 1{,}157625$ *then* $1{,}157625 \times 225 =$ 260*l.* 2*s.* 3*d.* 3 *qrs.*

2. What will 200l. amount to in 4 years, at 5 per cent. per annum? *Ans.* 243*l.* 2,025*s.*

3. What will 450l. amount to in 5 years, at 4 per cent. per annum? *Ans.* 547*l.* 9*s.* 10*d.* 2,0538368 *qrs.*

4. What will 500l. amount to in 4 years, at $5\frac{1}{2}$ per cent. per annum? *Ans.* 619*l.* 8*s.* 2*d.* 3,8323 *qrs.*

II. *When* A, R, T, *are given, to find* P.

Rule. $\frac{a}{r^{t}} = P$.

EXAMPLES.

5. What principal being put to interest will amount to 260l. 9s. 3d. 3 qrs. in 3 years, at 5 per cent. per ann.?

$$1{,}05 \times 1{,}05 \times 1{,}05 = 1{,}157625. \quad \frac{260{,}465625}{1{,}157625} = 225l.$$

6. What principal being put to interest will amount to 243l. 2,025s. in 4 years, at 5 per cent. per annum? *Ans.* 200*l.*

7. What principal will amount to 547l. 9s. 10d. 2,0538368 qrs. in 5 years, at 4 per cent. per annum? *Ans.* 250*l.*

8. What principal will amount to 619l. 8s. 2d. 3,8323 qrs. in 4 years, at 5½ per cent.? *Ans.* 500*l.*

III. *When* P, A, T, *are given, to find* R.

RULE.—$\frac{a}{p} = r^{t}$ *which being extracted by the rule of extraction, (the time given to the question shewing the power) will give* R.

EXAMPLES.

9. At what rate per cent. will 225l. amount to 260l. 9s. 3d. 3 qrs. in 3 years? *Ans.* 5 *per cent.*

$\frac{260{,}465625}{225} = 1{,}157625.$ *the cube root of which (it being the* 3*d power)*$=1{,}05=5$ *per cent.*

10. At what rate per cent. will 200l. amount to 243l. 2,025s. in 4 years? *Ans.* 5 *per cent.*

11. At what rate per cent. will 450l. amount to 547l. 9s. 10d. 2,0538368 qrs. in 5 years? *Ans.* 4 *per cent.*

12. At what rate per cent. will 500l. amount to 619l. 8s. 2d. 3,8323 qrs. in 4 years? *Ans.* 5½ *per cent.*

IV. *When* P, A, R, *are given, to find* T.

RULE.—$\frac{a}{p} = r^{t}$ *which being continually divided by* R, *till nothing remains, the number of those divisions will be equal to* T.

EXAMPLES.

EXAMPLES.

13. In what time will 225l. amount to 260l. 9s. 3d. 3 qrs. at 5 per cent.?

$$\frac{260{,}465625}{225}=1{,}157625\frac{1{,}157625}{1{,}05}=1{,}1025\frac{1{,}1025}{1{,}05}=1{,}05\frac{1{,}05}{1{,}05}$$

$=1$. *The number of divisions being* 3=*times sought.*

14. In what time will 200l. amount to 243l. 2,025s. at 5 per cent.? *Ans.* 4 *years.*

15. In what time will 450l. amount to 547l. 9s. 10d. 2,0538368 qrs. at 4 per cent.? *Ans.* 5 *years.*

16. In what time will 500l. amount to 619l. 8s. 2d. ,38323 qrs. at 5½ per cent.? *Ans.* 4 *years.*

ANNUITIES, OR PENSIONS IN ARREARS.

☞ U *represents the annuity, pension, or yearly rent;* A, R, T, *as before.*

A TABLE, shewing the amount of 1l. annuity for any number of years under 31, at 5 and 6 per cent. per ann.

Years.	5 *Rates*	6	*Years.*	5 *Rates*	6
1	1,00000	1,00000	16	23,65749	25,67252
2	2,05000	2,06000	17	25,84036	28,21288
3	3,15250	3,18360	18	28,13238	30,90565
4	4,31012	4,37461	19	30,53900	33,75999
5	5,52563	5,63709	20	33,06595	36,78559
6	6,80191	6,97532	21	35,71925	39,99272
7	8,14200	8,39383	22	38,50521	43,39229
8	9,54910	9,89746	23	41,43047	46,99582
9	11,02656	11,49131	24	44,50199	50,81557
10	12,57789	13,18079	25	47,72709	54,86451
11	14,20678	14,97164	26	51,11345	59,15638
12	15,91712	16,86994	27	54,66912	63,70576
13	17,71298	18,88213	28	58,40258	68,52811
14	19,59863	21,01506	29	62,32271	73,63979
15	21,57856	23,27597	30	66,43884	79,05818

☞ *The above table is made thus: take the first year's amount, which is* 1*l. multiply it by* 05+1=2,05=*second year's amount, which also multiply by* 1 1,05+1=3,1525= *third year's amount.*

I. *When* U, T, R, *are given, to find* A.

Rule. $\frac{ur^t-u}{r-1}=A$, *or by the table, thus:*

Multiply the amount of 1l. for the number of years, and at the rate per cent. given in the question, by the annuity, pension, &c. and it will give the answer.

EXAMPLES.

17. What will an annuity of 50l. per annum, payable yearly, amount to in 4 years at 5 per cent.?

Ans. 1,05 × 1,05 × 1,05 × 1,05 × 50 = 60,77531250

then $\frac{60,7753125-50}{1,05-1}$ = 215*l.* 10*s.* 1*d.* 2 *qrs.* *or,*

by the table thus, 4,31012 × 50 = 215*l.* 10*s.* 1*d.* 1,76 *qrs.*

18. What will a pension of 45l. per annum, payable yearly, amount to in 5 years, at 5 per cent.?

Ans. 248*l.* 13*s.* 3,27 *qrs.*

19. If a salary of 40l. per annum, to be paid yearly, be forborne 6 years, at 6 per cent. what is the amount?

Ans. 279*l.* 3,072*d.*

20. If an annuity of 75l. per annum, payable yearly, be omitted to be paid for 10 years, at 6 per cent. what is the amount? *Ans.* 988*l.* 11*s.* 2,22*d.*

II. *When* A, R, T, *are given, to find* U.

Rule. $\frac{ar-a}{rt-1}=U$.

EXAMPLES.

21. What annuity, being forborne 4 years, will amount to 215l. 10s. 1d. 2 qrs. at 5 per cent.?

Ans. $\frac{215,50625 \times 1,05 - 215,50625}{1,5 \times 1,05 \times 1,05 \times 1,05 - 1}$ = 50*l.*

22. What pension, being forborne 5 years, will amount to 248l. 13s. 3,27 qrs. at 5 per cent.? *Ans.* 45*l.*

23. What salary, being omitted to be paid 6 years, will amount to 279l. 3,072d. at 6 per cent.? *Ans.* 40*l.*

24. If the payment of an annuity, being forborne 10 years, amount to 988l. 11s. 2,22d. at 6 per cent. what is the annuity? *Ans.* 75*l.*

III. *When* U, A, R, *are given, to find* T.

Rule. $\frac{ar+u-a}{u}=r^t$ *which being continually divided by* R, *till nothing remains, the number of those divisions will be equal to* T.

EXAMPLES.

25. In what time will 50l. per annum amount to 215l. 10s. 1d. 2 qrs. at 5 per cent. for non-payment?

Ans. $\frac{215,50625 \times 1,05 \times 50 - 215,50625}{50}=1,21550625$

which being continually divided by R, *the number of those divisions will be* = 4 *years.*

26. In what time will 45l. per annum amount to 248l. 13s. 3,27 qrs. allowing 5 per cent. forbearance of payment? *Ans.* 5 *years.*

27. In what time will 40l. per annum amount to 279l. 3,072, at 6 per cent.? *Ans.* 6 *years.*

28. In what time will 75l. per annum amount to 988l. 11s. 2,22d. allowing 6 per cent. for forbearance of payment? *Ans.* 10 *years.*

PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

A TABLE shewing the present worth of 1l. annuity for any number of years under 31, rebate at 5 and 6 per cent.

Years.	5 *Rates*	6	*Years.*	5 *Rates*	6
1	0,95238	0,94339	16	10,83777	10,10589
2	1,85941	1,83339	17	11,27406	10,47726
3	2,72324	2,67301	18	11,68958	10,82760
4	3,54595	3,46510	19	12,08532	11,15811
5	4,32947	4,21236	20	12,46221	11,46992
6	5,07569	4,91732	21	12,82115	11,76407
7	5,78637	5,58238	22	13,16300	12,04158
8	6,46321	6,20979	23	13,48857	12,30338
9	7,10782	6,80169	24	13,79864	12,55035
10	7,72173	7,36008	25	14,09394	12,78335
11	8,30641	7,88687	26	14,37518	13,00316
12	8,86325	8,38384	27	14,64303	13,21053
13	9,39357	8,85268	28	14,89812	13,40616
14	9,89864	9,29498	29	15,14107	13,59072
15	10,37965	9,71225	30	15,37245	13,76483

☞ *The above table is thus made: divide* 1l. *by* 1,05= ,95238, *the present worth of the first year, which* ÷ 1,05= ,90703, *added to the first year's present worth,* = 1,85941, *the second year's present worth; then,* 90703÷1,05 *and the quotient added to* 1,85941=2,72324, *third year's present worth, &c.*

I. *When* U, T, R, *are given, to find* R.

RULE. $$\frac{u - \frac{u}{r^t}}{r-1} = P.$$

or, by the table, thus:

Multiply the present worth of 1l. annuity for the time and rate per cent. given, by the annuity, pension, &c. it will give the answer.

EXAMPLES.

EXAMPLES.

29. What is the present worth of an annuity of 30l. per annum, to continue 7 years, at 6 per cent.?

Ans. 167*l.* 9*s.* 5. ,184*d.*

$$\frac{30}{1,50363}=19,9517.\quad 30-19,9517=10,0483.\quad \frac{10,0483}{1,06-1}$$

$=167,4716$. *By the table* $5,58238\times30=167,4716$.

30. What is the present worth of a pension of 40l. per annum, to continue 8 years, at 5 per cent.?

Ans. 258*l.* 10*s.* 6*d.* 3,264 *qrs.*

31. What is the present worth of a salary of 35l. to continue 7 years, at 6 per cent.?

Ans. 195*l.* 7*s.* 7*d.* 3,968 *qrs.*

32. What is the yearly rent of 50l. to continue 5 years, worth in ready money, at 5 per cent.?

Ans. 216*l.* 9*s.* 5*d.* 2,56 *qrs.*

II. *When* P, T, R, *are given, to find* U.

RULE. $\dfrac{\overline{pr^{t}}\times r-pr^{t}}{r^{t}-1}=U.$

EXAMPLES.

33. If an annuity be purchased for 167l. 9s. 5. ,184d. to be continued 7 years, at 6 per cent. what is the annuity?

Ans. $\dfrac{\overline{167,4716\times1,50363\times1,06}-167,4716\times1,50363}{1,50363-1}=30l.$

34. If the present payment of 258l. 10s. 6d. 3,264 qrs. be made for a salary 8 years to come, at 5 per cent. what was the salary? *Ans.* 40*l.*

35. If the present payment of 195*l.* 7*s.* 7*d.* 3,968 qrs. were required for a pension for 7 years to come, at 6 per cent. what is the pension? *Ans.* 35*l.*

36. If the present worth of an annuity, 5 years to come, be 216l. 9s. 5d. 2,56 qrs. at 5 per cent. what is that annuity? *Ans.* 50*l.*

III. *When* U, P, R, *are given, to find* T.

RULE. $\frac{u}{p+u-pr}=r^t$ *which being continually divided by* R, *till nothing remains, the number of those divisions will be equal to* T.

EXAMPLES.

37. How long may a lease of 30l. yearly rent be had for 167l. 9s. 5.,184d. allowing 6 per cent. to the purchaser?

Ans. $\frac{30}{167{,}4716+30-177{,}5198}=1{,}50363$ *which being continually divided, the number of those divisions will be* $=$ *to* T. $=$ 7 *years.*

38. If 258l. 10s. 6d. 3,264 qrs. is paid down for a lease of 40l. per annum, at 5 per cent. how long is the lease purchased for? *Ans.* 8 *years.*

39. If a house is let upon lease for 35l. per annum, and the lessee makes present payment of 195l. 7s. 8d. he being allowed 6 per cent. I demand how long the lease is purchased for? *Ans.* 7 *years.*

40. For what time may a lease of 50l. per annum be purchased, when present payment is made of 216l. 9s. 5d. 2,56 qrs. at 5 per cent.? *Ans.* 5 *years.*

ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

To find the present worth of annuities, leases, &c. taken in reversion.

RULE 1. Find the present worth of the annuity, &c. at the given rate, and for the time of its continuance, *thus,*

$$\frac{u-\frac{u}{rt}}{r-1}=P.$$

2. Change P into A, and find what principal being put to interest will amount to P at the same rate, and for the time to come, before the annuity commences, which will be the present worth of the annuity, &c. *thus*

$$\frac{a}{r^t}=P.$$

EXAMPLES.

41. What is the present worth of a reversion of a lease of 40l. per annum, to continue for 6 years, but not to commence till the end of 2 years, allowing 6 per cent. to the purchaser? *Ans.* 175*l.* 1*s.* 1*d.* 2,048 *qrs.*

$$\frac{40}{1{,}41852}=28{,}1984\quad\frac{40-28{,}1984}{1{,}06-1}=196{,}6933\quad\frac{196{,}6933}{1{,}1236}=175{,}0563$$

42. What is the present worth of a reversion of a lease of 60l. per annum, to continue 7 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser? *Ans.* 299*l.* 18*s.* 2. 4*d.*

43. There is a lease of a house at 30l. per annum, which is yet in being for 4 years, and the lessee is desirous to take a lease in reversion for 7 years, to begin when the old lease shall be expired, what will be the present worth of the said lease in reversion, allowing 5 per cent. to the purchaser? *Ans.* 142*l.* 16*s.* 3. 2,688 *qrs.*

To find the yearly income of an annuity, &c. taken in reversion.

Rule. Find the amount of the present worth, at the given rate, and for the time before the annuity commences, *thus* $pr^t=A$.

Change A into P, and find what yearly rent being sold will produce P, at the same rate, and for the time of its continuance, which will be the yearly sum required, *thus*, $\frac{pr^t\times r-prt}{r^t-1}=U$.

EXAMPLES.

44. What annuity, to be entered upon 2 years hence, and then to continue 6 years, may be purchased for 175l. 1s. 1d. 2,048 qrs. at 6 per cent.?

Ans. $175{,}0563\times 1{,}1236=196{,}6933$

then $\frac{199{,}6933\times 1{,}41852\times 1{,}06-279{,}01337}{1{,}41852-1}=40l.$

45. The present worth of the lease of an house is 299l. 18s. 2,4d. taken in reversion for 7 years, but not to

commence till the end of 3 years, allowing 5 per cent. to the purchaser, what is the yearly rent? *Ans.* 60*l.*

46. There is a lease of a house in being for 4 years, and the lessee being minded to take a lease in reversion for 7 years, to begin when the old lease shall be expired, paid down 142l. 16s. 3d. 2,688 qrs. what was the yearly rent of the house, when the lessee was allowed 5 per cent. for present payment? *Ans.* 30*l.*

Purchasing FREEHOLD *or* REAL ESTATES *is such as are bought to continue for ever.*

I. *When* U, R, *are given, to find* W.

RULE. $\dfrac{u}{r-1}=W.$

EXAMPLES.

47. What is the worth of a freehold estate of 50l. per annum, allowing 5 per cent. to the buyer?

$$Ans.\ \frac{50}{1{,}05-1}=1000l.$$

48. What is an estate of 140l. per annum, to continue for ever, worth in present money, allowing 4 per cent. to the buyer? *Ans.* 3500*l.*

49. If a freehold estate of 75l. yearly rent was to be sold, what is it worth, allowing the buyer 6 per cent.? *Ans.* 1250*l.*

II. *When* W, R, *are given, to find* U.

RULE. $w\times\overline{r-1}=U.$

EXAMPLES.

50. If a freehold estate is bought for a 1000l. and the allowance of 5 per cent. is made to the buyer, what is the yearly rent? *Ans.* 1,05—1=,05. *then* 1000×,05=50*l.*

51. If an estate be sold for 3500l. and 4 per cent. allowed to the buyer, what is the yearly rent? *Ans.* 140*l.*

52. If a freehold estate is bought for 1250l. present money, and an allowance of 6 per cent. made to the buyer for the same, what is the yearly rent? *Ans.* 75*l.*

III. *When* W, U, *are given, to find* R.

RULE. $\dfrac{w+u}{w}=R.$

EXAMPLES.

53. If an estate of 50l. per annum is bought for 1000l. what is the rate per cent.?

Ans. $\frac{1000+50}{1000}=1{,}05=5$ *per cent.*

54. If a freehold estate of 140l. per annum be bought for 3500, what was the rate per cent. allowed? *Ans.* 4 *per cent.*

55. If an estate of 75l. per annum is sold for 1250l. what is the rate per cent. allowed? *Ans.* 6 *per cent.*

Purchasing FREEHOLD ESTATES *in* REVERSION.

To find the worth of a freehold estate in reversion.

RULE. Find the worth of the yearly rent, *thus* $\frac{u}{r-1}=\text{W}$. Change W into A, and find what principal being put to interest will amount to A at the same rate, and for the time to come, before the estate commences, and that will be the worth of the estate in reversion; *thus,* $\frac{a}{rt}=\text{P}$.

EXAMPLES.

56. If a freehold estate of 50l. per annum, to commence 4 years hence, is to be sold, what is it worth allowing the purchaser 5 per cent. for present payment?

Ans. $\frac{50}{1{,}05-1}=1000$. *then* $\frac{1000}{1{,}21555}=$ 822*l.* 14*s.* 1*d.* 2 *qrs.* +

57. What is an estate of 200l. to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaser 4 per cent.?

Ans. 4622*l.* 15*s.* 7*d.* ,44 *qrs.*

58. What is an estate of 240l. per annum worth in ready money, to continue for ever, but not to commence till the end of 3 years, allowance being made at 6 per cent.

Ans. 3358*l.* 9*s.* 10*d.* 2,24 *qrs.*

To find the yearly rent of an estate taken in reversion.

RULE. Find the amount of the worth of the estate, at the given rate and time before it commences: *thus,* $wr^t=\text{A}$.

Change A into W, and find what yearly Rent being sold will produce U, at the same rate; thus, $\frac{wr\times r-wr}{r}=U.$ which will be the yearly rent required.

EXAMPLES.

59. If a freehold estate, to commence 4 years hence, is sold for 822l. 14s. 1d. ,2 qrs. allowing the purchaser 5 per cent. what is the yearly income?

Ans. 822,70625 × 1,2155 = 1000

$$\textit{then}\ \frac{1000\times1,05\times1,05-1050}{1,05}=50l.$$

60. A freehold estate is bought for 4622l. 15s. 7. ,44d. which does not commence till the end of 2 years, the buyer being allowed 4 per cent. for his money, I desire to know the yearly income? *Ans.* 200*l.*

61. There is a freehold estate sold for 3358l. 9s. 10d. 2,24 qrs. but not to commence till the expiration of 3 years, allowing 6 per cent. for present payment; what is the yearly income? *Ans.* 240*l.*

Rebate or Discount.

A TABLE shewing the present worth of 1l. due any number of years, to commence under 31, rebate at 5 and 6 per cent.

Years.	*Rates*		*Years.*	*Rates*	
	5	6		5	6
1	,952381	,943396	16	,458111	,393647
2	,907030	,889996	17	,436296	,371364
3	,863838	,839619	18	,415520	,350343
4	,822702	,792093	19	,395734	,330513
5	,783526	,747258	20	,376889	,311804
6	,746215	,704960	21	,358942	,294155
7	,710682	,665057	22	,341849	,277505
8	,676839	,627412	23	,325571	,261797
9	,644609	,591898	24	,310067	,246978
10	,613913	,558394	25	,295302	,232998
11	,584679	,526787	26	,281240	,219810
12	,556837	,496969	27	,267848	,207368
13	,530321	,468839	28	,255093	,195630
14	,505068	,442301	29	,242946	,184556
15	,481017	,417265	30	,231377	,174110

☞ *The above table is thus made:* 1÷1,05=952381 *first year's present worth; and* ,952381÷1,05=,90703 *second year; and* ,90703÷1,05=,863838 *third year, &c.*

I. *When* S, T, R, *are given, to find* P.

Rule. $\frac{s}{r^t}=P$.

EXAMPLES.

1. What is the present worth of 315l. 12s. 4. ,2d. payable 4 years hence, at 6 per cent.?

Ans. 1,06×1,06×1,06=1,26247. *then by the table,*

$$\frac{315,6175}{1,26247}=250l. \qquad \begin{array}{r} 315,6175 \\ ,792093 \\ \hline 249,9984124275 \end{array}$$

2. If 344l. 14s. 9d. 1,92 qrs. be payable in 7 years time, what is the present worth, rebate being made at 5 per cent.? *Ans.* 245*l.*

3. There is a debt of 441l. 17s. 3d. 1,92 qrs. which is payable 4 years hence, but it is agreed to be paid in present money; what sum must the creditor receive, rebate being made at 6 per cent.? *Ans.* 350*l.*

II. *When* P, T, R, *are given, to find* S.

Rule. $p\times r^t=S$.

EXAMPLES.

4. If a sum of money, due 4 years hence, produce 250l. for the present payment, rebate being made at 6 per cent. what was the sum first due?

Ans. 250×1,26247=315*l.* 12*s.* 4. ,2*d.*

5. If 245l. be received for a debt payable 7 years hence, and an allowance of 5 per cent. to the debtor for the present payment, what was the debt? *Ans.* 344*l.* 14*s.* 9*d.* 1,92 *qrs.*

6. There is a sum of money due at the expiration of 4 years, but the creditor agrees to take 350l. for present payment, allowing 6 per cent. what was the debt?

Ans. 441*l.* 17*s.* 3*d.* 1,92 *qrs.*

III. *When* S, P, R, *are given, to find* T.

RULE. $\frac{s}{p}=r^{t}$ *which being continually divided by* R, *till nothing remains, the number of those divisions will be equal to* T.

EXAMPLES.

7. The present payment of 250l. is made for a debt of 315l. 12s. 4. ,2d. rebate at 6 per cent. in what time was the debt payable?

Ans. $\frac{315,6175}{250}=1,26247$ *which being continually divided, those divisions will be equal to* 4 *=the number of years.*

8. A person receives 245l. now, for a debt of 344l. 14s. 9d. 1,92 qrs. rebate being made at 5 per cent. I demand in what time the debt was payable? *Ans.* 7 *years.*

9. There is a debt of 441l. 17s. 3d. 1,92 qrs. due at a certain time to come, but 6 per cent. being allowed to the debtor for the present payment of 350l. I desire to know in what time the sum should have been made without any rebate? *Ans.* 4 *years.*

IV. *When* S, P, T, *are given, to find* R.

RULE. $\frac{s}{p}=r^{t}$ *which being extracted by the rules of extraction, (the time given in the question shewing the power) will be equal to* R.

EXAMPLES.

10. A debt of 315l. 12s. 4. ,2d. is due 4 years hence, but it is agreed to take 250l. now, what is the rate per cent. that the rebate is made at?

Ans. $\frac{315,6175}{250}=1,26247:\sqrt{1,26247}=1,06=6$ *per cent.*

11. The present worth of 344l. 14s. 9d. 1,22 qrs. payable 7 years hence, is 245l. at what rate per cent. is rebate made? *Ans.* 5 *per cent.*

12. There is a debt of 441l. 17s. 3d. 1,92 qrs. payable in 4 years time, but it is agreed to take 350l. present payment, I desire to know what rate per cent. rebate is made at? *Ans.* 6 *per cent.*

FINIS.